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By the Secretary of State, Hon. ELIHU ROOT

FIGHTING THE POLAR ICE. Illustrated

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THE NATIONAL GEOGRAPHIC MAGAZINE

AËRIAL LOCOMOTION

With a Few Notes of Progress in the Construction of an Aërodrome*

By Alexander Graham Bell

Formerly President of the National Geographic Society

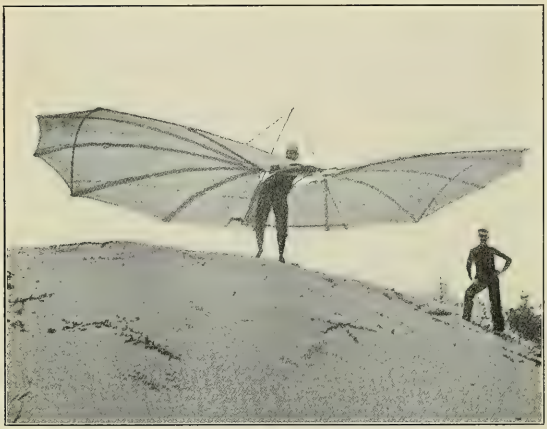
THE history of aërial locomotion is full of tragedies, and this is specially true where flying-machines are concerned. Men have gone up in balloons, and most of them have come down safely. Men have launched themselves into the air on wings, and most have met with disaster to life or limb. There have been centuries of effort to produce a machine that should fly like a bird, and carry a man whithersoever he willed through the air; and previously to 1783, the year sacred to the memory of the brothers Montgolfier, all experiments at aërial locomotion had this end exclusively in view.

Then came a period when the conquest of the air was sought through the agency of balloons. For more than one hundred years the efforts of experimenters were chiefly directed to the problem of rendering the balloon dirigible; and the earlier experiments with gliding machines, and artificial wings, and the projects of men to drive heavy bodies through the air by means of propellers were largely forgotten. The balloon was changed from its original spherical form to a shape better adapted for propulsion; and at last, through the efforts of Santos Dumont, we have arrived at the dirigible balloon of today. But in spite of the dirigibility of the modern balloon, it has so far been found impracticable to impart to this frail structure a velocity sufficient to enable it to make headway against anything but the mildest sort of wind. The character of the balloon problem has therefore changed. Velocity of propulsion rather than dirigibility is now the chief object of research.

THE BIRDS ARE ONCE MORE RECOGNIZED AS THE TRUE MODELS OF FLIGHT

It has long been recognized by a growing school of thinkers that an aërial vehicle, in order to cope with the wind, should be specifically heavier than the air through which it moves. This position is supported by the fact that all of Na-

*An address read before the Washington Academy of Sciences, December 13, 1906, and specially revised by Dr Bell for publication in the National Geographic Magazine.



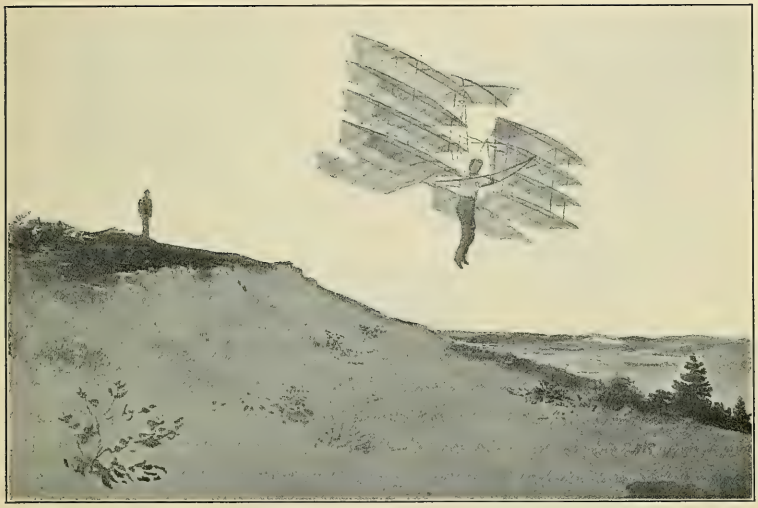
Lilienthal Gliding Machine as Reproduced in America for Chanute by Herring

ture's flying models, from the smallest insect to the largest bird, are specifically heavier than the air in which they fly, most of them many hundreds of times heavier, and that none of them adopt the balloon principle in flight. It is also significant in this connection that some of Santos Dumont's most celebrated exploits were accomplished with quite a small balloon, so ballasted as to sink in the air instead of rise. He was then enabled, under the influence of his motive power, to steer his balloon upward without the expenditure of ballast and to descend without the loss of gas. This probably typifies, for the balloon, the direction of change in the future. A reduction in the volume of gas coincidently with an increase in motive power will lead to greater velocity of propulsion, now the main desideratum. Then dependence upon velocity for support rather than gas may gradually lead to the elimination of the gas bag altogether; in which case the balloon will give birth to a flying machine of the heavier-than-air type.

However this may be, it is certainly the case that the tendency of aërial research is today reverting more and more to the old lines of investigation that were pursued for hundreds of years before the invention of the balloon diverted attention from the subject. The old devices have been reinvented; the old experiments have been tried once more. Again, the birds are recognized as the true models of flight, and again men have put on wings, but this time with more promise of success.

THE GLIDING FLIGHTS OF LILIENTHAL

Lilienthal boldly launched himself into the air in an apparatus of his own construction, having wings like a bird and a tail for a rudder. Without any motor, he ran down hill against the wind. Then, upon jumping into the air, he found himself supported by his apparatus, and glided down hill at an elevation of a few feet from the ground, landing safely at a considerable distance from his point of departure. This exhibition of gliding flight fairly startled the world, and henceforth the experiments of Lilienthal were conducted in the public eye. He made hundreds of successful flights with his gliding machine, varying its construction from time to time, and communicating to the world the results of his experiments with practical directions how to manage the machine under circumstances of difficulty; so that, when at last he met with the usual fate of his predecessors in this line, the experiments were not abandoned. They were continued in America by



Gliding Through the Air on Chanute's Multiple-winged Glider

Chanute of Chicago, Herring, and other Americans, including the Wright brothers, of Dayton, Ohio.

Hargrave of Australia attacked the flying-machine problem from the standpoint of a kite, communicating his results to the Royal Society of New South Wales. It is to him we owe the modern form of kite known as the "Hargrave box kite," which surpasses in stability all previous forms of kites. He also constructed successful flying-machine models on a small scale, using a store of compressed air as his motive power. He did not attempt to construct a large-sized apparatus or to go up into the air himself; so he still lives, to carry on researches that are of interest and value to the world.

SUCCESSFUL FLIGHT OF PROFESSOR LANGLEY'S MODEL

No one has contributed more to the modern revival of interest in flying-machines of the heavier-than-air type than our own Professor Langley, the late Secretary of the Smithsonian Institution. The constant failures and disasters of the past had brought into disrepute the whole subject of aërial flight by man; and the would-be inventor or experimenter had to face not only the natural difficulties of his subject, but the ridicule of a skeptical world. To Professor Langley is due the chief credit of placing this subject upon a scientific basis, and of practically originating what he termed the art of "aërodromics." In his epoch-making work on "Experiments in Aërodynamics," published in 1891 among the Smithsonian Contributions to Knowledge, he prepared the world for the recent advances in this art by announcing that—

> "The mechanical sustention of heavy bodies in the air, combined with very great speeds, is not only possible, but within reach of mechanical means we actually possess."

He also attempted to reduce his principles to practice by the construction of a

Langley's Aërodrome No. 5 in Flight, May 6, 1896
From instantaneous photograph by Alexander Graham Bell

large model of an aërodrome driven through the air by a steam-engine under the action of its own propellers. I was myself a witness of the memorable experiments made by Professor Langley on the 6th of May, 1896, with this large-sized model, which had a spread of wing of about 14 feet. No one who witnessed the extraordinary spectacle of a steam-engine flying with wings in the air, like a great soaring bird, could doubt for one moment the practicability of mechanical flight. I was fortunate in securing a photograph of this machine in full flight in the air, so that an automatic record of the achievement exists (page 4). The experiment realized the utmost hopes and wishes of Professor Langley at that time:

"I have brought to a close," he says, "the portion of the work which seemed to be specially mine—the demonstration of the practicability of mechanical flight; and for the next stage, which is the commercial and practical development of the idea, it is probable that the world may look to others. The world indeed will be supine if it does not realize that a new possibility has come to it, and that the great universal highway over head is now soon to be opened."

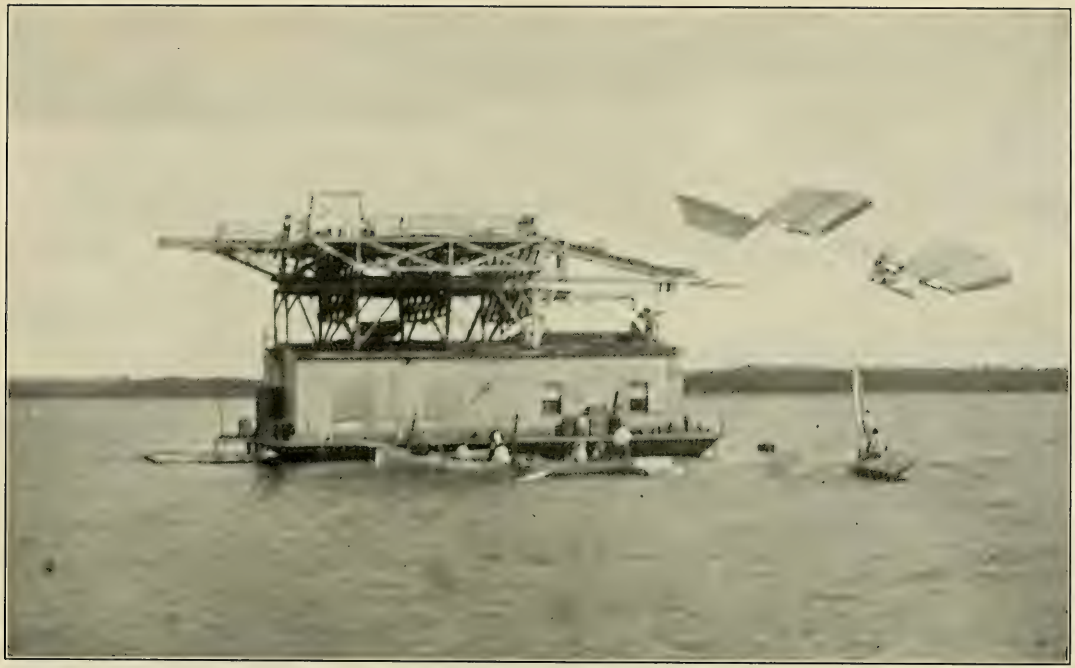
But the world was not satisfied with this position. It looked to Professor Langley himself to carry on the experiments to the point of actually transporting a human being through the air on an aërodrome like his model; and so, with the aid of an appropriation from the War Department of the United States, Professor Langley actually constructed a full-sized aërodrome, and found a man brave enough to risk his life in the apparatus—Mr Manley, of Washington, D. C.

LANGLEY'S EXPERIMENTS WITH HIS LARGE MACHINE

Great public interest was aroused; but Professor Langley did not feel justified in giving information to the public, and therefore to foreign nations, concerning experiments undertaken in the interests of the War Department. His own dislike to premature publicity coöperated with his conscientious scruples to lead him to deny the newspapers the opportunity of witnessing the experiments. But the newspapers insisted upon being represented. The correspondents flocked to the scene, and camped there for weeks, at considerable expense to their papers. They watched the house-boat containing the aërodrome by day and by night, and upon the least indication of activity within, newspaper reporters were on hand in boats. After long delay in hopes of securing privacy it was at last decided to try the apparatus; but the newspaper representatives, embittered by the attempts to exclude them, were bringing the experiments into public contempt. They nicknamed the apparatus "The Buzzard," and were all ready to presage defeat.

Two experiments were made; but on both occasions the apparatus caught in the launching ways and was precipitated into the water without having a chance to show what it could do in the air. The newspapers immediately announced to the world the failure of Professor Langley's machine and ridiculed his efforts. The fact of the matter is that the machine was never tried, and that there was no more reason for declaring it a failure than for deciding that a ship would not float that has never been launched. After having witnessed the successful flight of the large-sized model of 1896, I have no doubt that Professor Langley's full-sized aërodrome would have flown had it been safely launched into the air.

When the machine was for the second time precipitated into the water it was not much damaged by the accident. Professor Langley, of course, was more anxious about the fate of his intrepid assistant than of his machine, and followed Mr Manley into the house-boat to ascertain his condition. During this temporary withdrawal from the scene of the catastrophe the crew of a tugboat grappled the frail framework of the submerged aërodrome, and in the absence of any one competent to direct their efforts they broke the machine to pieces, thus ending the possibility of further experiments without the expenditure of much



The Accident to Langley's Aërodrome

From an instantaneous photograph loaned by the Smithsonian Institution. The machine caught in the launching ways and was injured, being precipitated into the water without having a chance to show what it could do in the air

capital. The ridicule of the newspapers, however, effectually prevented Professor Langley from securing further financial aid, and, indeed, broke his heart. There can be little doubt that the unjust treatment to which he was exposed contributed materially to the production of the illness that caused his death.

He lived long enough, however, to know of the complete fruition of his hopes by others, and only two days before his death he had the gratification of receiving a communication from the newly formed Aëro Club of America recognizing and appreciating his efforts to promote mechanical flight. This communication read as follows:

RESOLUTIONS OF THE AERO CLUB OF AMERICA, ADOPTED JANUARY 20, 1906

"WHEREAS our esteemed colleague, Dr S. P. Langley, Secretary of the Smithsonian Institution, met with an accident in launching his aërodrome, thereby missing a decisive test of the capabilities of this man-carrying machine, built after his models which flew successfully many times; and

"WHEREAS, in that difficult experiment, he was entitled to fair judgment and distinguished consideration because of his important achievements in investigating the laws of dynamic flight, and in the construction of a variety of successful flying models: Therefore be it

"Resolved, That the Aëro Club of America, holding in high estimation the contributions of Dr Langley to the science of aërial locomotion, hereby expresses to him its sincerest appreciation of his labors as a pioneer in this important and complex science; and be it further

"Resolved, That a copy of these resolutions be sent to the Board of Regents of the Smithsonian Institution, and to Doctor Langley."

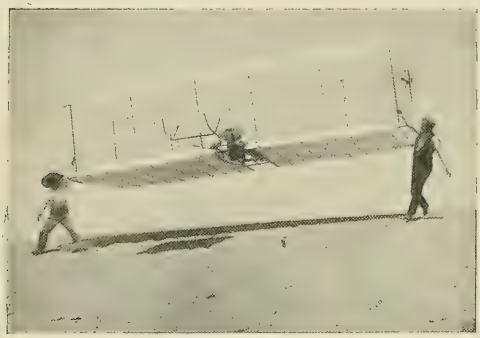
Professor Langley was on his deathbed when these resolutions were brought to his attention, and when asked what should be done with the communication his pathetic answer was, *"Publish it."* To all who know his extreme aversion to publicity in any form this reply indicates how keenly he felt the misrepresentations of the press.

THE FIRST PRACTICAL FLYING MACHINE

Both in the case of Lilienthal and Langley their efforts have not been in vain. Others have continued their researches, and today the world is in possession of the first practical flying-machine, the creation of the brothers Orville and Wilbur Wright, of Dayton, Ohio. Indeed, we have news from France that a second has just appeared, constructed by the same Santos Dumont to whom the world already owes the first practical dirigible balloon.

The Wright brothers began by repeating the gliding experiments of Lilienthal, with improved apparatus of the Hargrave type as modified by Chanute. After having made many successful glides through the air without a motor, they followed in the footsteps of Langley and propelled their machine by means of twin screws operated by engine power. They were successful in launching their apparatus into the air, and it flew, carrying one of them with it. Their machine has flown not once simply, but many times, and in the presence of witnesses; so that there can be no doubt that the first successful flying-machine has at last appeared. Specially successful flights were made on the 3d and 4th of October, 1905, which were referred to by the Wright brothers in a letter to the editor of *L'Aerophile* published in that journal January, 1906. They have also made a communication upon the subject to the Aëro Club of America, and have received the formal congratulations of that organization upon their success.

Each of the Wright brothers in turn has made numerous flights over their testing field near Dayton, Ohio, sometimes at an elevation of about 80 feet; at other times skimming over the field at a height of about ten feet from the ground. They have been able to circle over the field of operation, and even to describe in the air the figure eight, thus demonstrating their perfect control over their apparatus, both in the vertical and horizontal directions. They have succeeded in remaining continuously in the air for more than half an hour—thirty-eight minutes, in fact—and only came



Starting a Flight

A High Glide

The Wright Brothers' Gliding Machine

down on account of the exhaustion of their fuel supply. They state that the velocity attained was one kilometer per minute, or about thirty-seven miles an hour. The machine has not only sustained its own weight in the air during these trials, but has also carried a man and a gasoline engine weighing 240 pounds, exerting a force of from 12 to 15 horse-power, and in addition an extra load of 50 pounds of pig-iron. The apparatus complete, with motor, weighed no less than 925 pounds, while the supporting surfaces consisted of two superposed aëroplanes each measuring six by forty feet; so that the machine as a whole had a flying weight of nearly two pounds per square foot (1.9 pounds).

Thanks to the efforts of the Wright brothers, the practicability of aërial flight by man is no longer problematical. We can no longer consider as impossible that which has already been accomplished. America may well feel proud of the fact that the problem has been first solved by citizens of the United States.

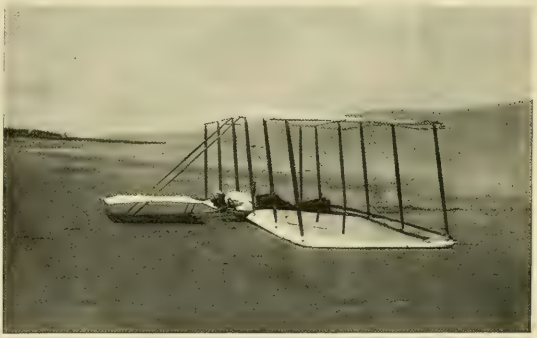
A FEW NOTES OF PROGRESS IN THE CONSTRUCTION OF AN AERODROME

For many years past—in fact, from my boyhood—the subject of aërial flight has had a great fascination for me. Before the year 1896 I had made many thousands of still unpublished experiments having a bearing upon the subject, and I was therefore much interested in the researches of Professor Langley relating to aërodynamics. We were thrown closely together in Washington, and although we rarely conversed upon aërodynamics we knew that we had a subject of mutual interest and showed the greatest personal confidence in one another. I did not hesitate to show him my experiments; he did not hesitate to show me his. At least as early as 1894 Professor Langley visited me in my Nova Scotia home and witnessed some of my experiments; and in May, 1896, he reciprocated by inviting me to accompany him to Quantico, Virginia, and witness a trial of his large-sized model. The sight of

Langley's steam aërodrome circling in the sky convinced me that the age of the flying-machine was at hand. Encouraged and stimulated by this remarkable exhibition of success, I quietly continued my experiments in my Nova Scotia laboratory in the hope that I, too, might be able to contribute something of value to the world's knowledge of this important subject.

Soaring

Warned by the experiences of others, I have sought for a safe method of approach — a method that should risk human life as little as possible during the earlier stages of experiment. Experiments with aërodromes must necessarily be fraught with danger until man, by practical experience of the conditions to be met with in the air and of the means of overcoming them, shall have attained skill in the control of aërial apparatus. A man cannot even ride a bicycle without practice, and the birds themselves have to learn to fly. Man, not having any inherited instincts to help him in this matter, must first control his flight consciously, guided by knowledge gained through experiment. Skill can only be obtained by actual experience in the air, and this experience will involve accidents and disasters of various sorts before skill can be obtained. If these disasters should, as so often in the past, prove fatal to the experimenter, the knowledge obtained by the would-be aviator will be lost to the world, and others must begin all over again, instead of pursuing the subject where he left off, with the benefit of his knowledge and his experience. It is therefore of the utmost consequence to



Landing

progress in the art of aviation that the first attempts to gain experience in the air should be made under such conditions of safety as to reduce to a minimum the liability to fatal results.

A MACHINE THAT WILL SUPPORT ITSELF AT LOW VELOCITY DESIRABLE

The Wright brothers' successful flying-machine travels at the rate of about thirty-seven miles an hour; and, judging from its great flying weight (nearly two pounds per square foot of supporting surface), it is unlikely that it could be maintained in the air if it had a very much less velocity. But should an accident happen to a body propelled through the air with the velocity of a railroad train, how about the safety of the occupants? Accidents will happen, sooner or later, and the chances are largely in favor of the first accident being the last experiment. While, therefore, we may look forward with confidence to the ultimate possession of flying-machines exceeding in speed the fastest railroad trains, it might be the part of wisdom to begin our first experiments at gaining experience in the air with machines traveling at such moderate velocities as to reduce the chances of a fatal catastrophe to a minimum. This means that they should be light-flying machines—that is, the ratio of weight to supporting surface should be small.

While theory indicates that the greater the weight in proportion to supporting surface consistent with flight, the more independent of the wind will the machine be, yet it might be advisable to begin, if possible, with such a moderate flying weight as to permit of the machine being flown as a kite. There would be little difficulty, then, in raising it into the air, and should an accident happen to the propelling machinery, the apparatus would descend gently to the ground; or the aviator could cast anchor, and his machine would continue flying, as a kite, if the wind should prove sufficient for its support. If it could fly, as a kite, in a ten-mile breeze, then a velocity of only ten miles an hour would be sufficient for its support as a flying-machine in calm air, while a less speed would suffice in heading into a moderate wind.

Such velocities would be consistent with safety in experiments, especially if the flights should be made over water instead of land, and at moderate elevations above the surface. Under such circumstances the inevitable accidents which are sure to happen during first experiments are hardly likely to be followed by more serious consequences than a ducking to the man and the immersion of the machine. If the man is able to swim and the machine to float upon water, little damage need be anticipated to either.

There are two critical points in every aërial flight—its beginning and its end. A flying-machine adapted to float upon water not only seems to afford a safe means of landing, but also promises a solution of that most difficult of problems—a safe method of launching the apparatus into the air. If the supporting floats are so formed as to permit of the machine being propelled over the surface of the water like a motor boat, then, if sufficient headway can be gained under the action of her aërial propellers, the machine can be steered upward into the air, rising from the water, after the manner of a water bird, in the face of the wind. This seems to be the safest method of gaining access to the air; but, of course, its practicability depends upon possibilities of lightness and speed yet to be demonstrated.

In any event, if the machine, man and all, is light enough to be flown as a kite, it can be towed out of the water into the air through the agency of a motor boat; and, upon land, it would not even be necessary for it to gain headway before rising, for in a supporting wind it would rise of itself into the air, if relieved of the weight of the man, and fly as a kite. It would then be a comparatively simple matter to lower the kite to a convenient height from the ground, and to hold it steadily in position by subsidiary lines

while the aviator ascends a rope ladder to his seat in the machine. In this way the man would not be exposed to danger during the critical operation of launching the apparatus into the air, and by a converse process a safe landing could be effected without bringing the machine to the ground. The chance of injury to the machine itself would also be much lessened by relieving it of the weight of the man during the initial process of launching and the final process of bringing the machine down to the ground.

Such speculations as these of course are only justifiable upon the assumption that it is possible to construct an aërial vehicle large enough and strong enough to support a man and an engine in the air, and yet light enough to be flown as a kite in a moderate breeze with the man and engine and all on board. My experiments in Nova Scotia have demonstrated that this can be done; and I now therefore find myself seriously engaged in the attempt to reduce these ideas to practice by the actual construction of an aërodrome of the kite variety. The progress of experiment may be divided into three well-marked stages: the kite stage, the motor-boat stage, and the free flying-machine rising from the water.

THE KITE STAGE

In April, 1899, I made my first communication on the subject of kites to the National Academy of Sciences in a paper entitled "Kites with Radial Wings," which was reviewed, with illustrations, in the *Monthly Weather Review* for April, 1899 (vol. XXVI, pp. 154-155, plate XI). I made another communication to the National Academy on the 23d of April, 1903, upon "The Tetrahedral Principle in Kite Structure," which was published, with ninety-one illustrations and an appendix, in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1903 (vol. XIV, pp. 220-251). The substance of the present address was presented in part to the National Academy of Sciences at their recent meeting in Boston, Massachusetts, November 21, 1906. The experiments referred to, which were undertaken at first for my own pleasure and amusement, have gradually assumed a serious character, from their bearing upon the flying-machine problem.

The word "kite" unfortunately is suggestive to most minds of a toy—just as the telephone at first was thought to be a toy; so that the word does not at all adequately express the nature of the enormous flying structures employed in some of my experiments. These structures were really aërial vehicles rather than kites, for they were capable of lifting men and heavy weights into the air. They were flown after the manner of kites, but their flying cords were stout manila ropes. They could not be held by hand in a heavy breeze, but had to be anchored to the ground by several turns of the ropes around stout cleats, like those employed on steamships and men-of-war.

One of the great difficulties in making a large structure light enough to be flown as a kite has been pointed out by Professor Simon Newcomb in an article in *McClure's Magazine*, published in September, 1901, entitled "Is the Air-Ship Coming?" and this difficulty had so much weight with him at that time as to lead him to the general conclusion that—

> "The construction of an aërial vehicle which could carry even a single man from place to place at pleasure requires the discovery of some new metal or some new force."

This conclusion the Wright brothers, and now Santos Dumont, have demonstrated to be incorrect; but Professor Newcomb's objections undoubtedly have great force, and reveal the cause of failures of attempts to construct large-sized flying-machines upon the basis of smaller models that actually flew. Professor Newcomb shows that where two aërial vehicles are made exactly alike, only differing in the scale of their dimensions, the ratio of weight to supporting surface is greater in the larger one than in the smaller, the weight increasing as the cube of the dimensions, whereas the supporting surfaces only increase as the squares. From this the conclusion is

obvious that if we make our structure large enough it will be too heavy to fly—even by itself—far less be the means of supporting an additional load like a man and an engine for motive power. This conclusion is undoubtedly correct in the case of structures that are "exactly alike excepting in their dimensions," but it is not true as a general proposition.

EVADING AN OLD LAW

A small bird could not sustain a heavy load in the air; and while it is true that a similar bird of double the dimensions would be able to carry a less proportionate weight, because it is itself heavier in proportion to its wing surface than the smaller bird—eight times as heavy, in fact, with only four times the wing surface—still it is conceivable that a flock of small birds could sustain a heavy load divided equally among them; and it is obvious that in this case the ratio of weight to wing surface would be the same for the whole flock as for the individual bird. If, then, we build our large structure by combining together a number of small structures each light enough to fly, instead of simply copying the small structure upon a larger scale, we arrive at a compound or cellular structure in which the ratio of weight to supporting surface is the same as that of the individual units of which it is composed, thus overcoming entirely the really valid objections of Professor Newcomb to the construction of large flying-machines.

Unit cell having the form of the regular tetrahedron.

In my paper upon the tetrahedral principle in kite structure I have shown that a framework having the form of a tetrahedron possesses in a remarkable degree the properties of strength and lightness. This is specially the case when we adopt as our unit structure the form of the regular tetrahedron, in which the skeleton frame is composed of six rods of equal length, as this form seems to give the maximum of strength with the minimum of material. When these tetrahedral frames or cells are connected together by their corners they compose a structure of remarkable rigidity, even when made of light and fragile material, the whole structure possessing the same properties of strength and lightness inherent in the individual cells themselves (page 12).

The unit tetrahedral cell yields the skeleton form of a solid, and it is bounded by four equal triangular faces. By covering two adjoining faces with silk, or other material suitable for use in kites, we arrive at the unit "winged cell" of the compound kite, the two triangular surfaces in their flying position resembling a pair of wings raised with their points upward, the surfaces forming a dihedral angle (Fig. A, p. 13).

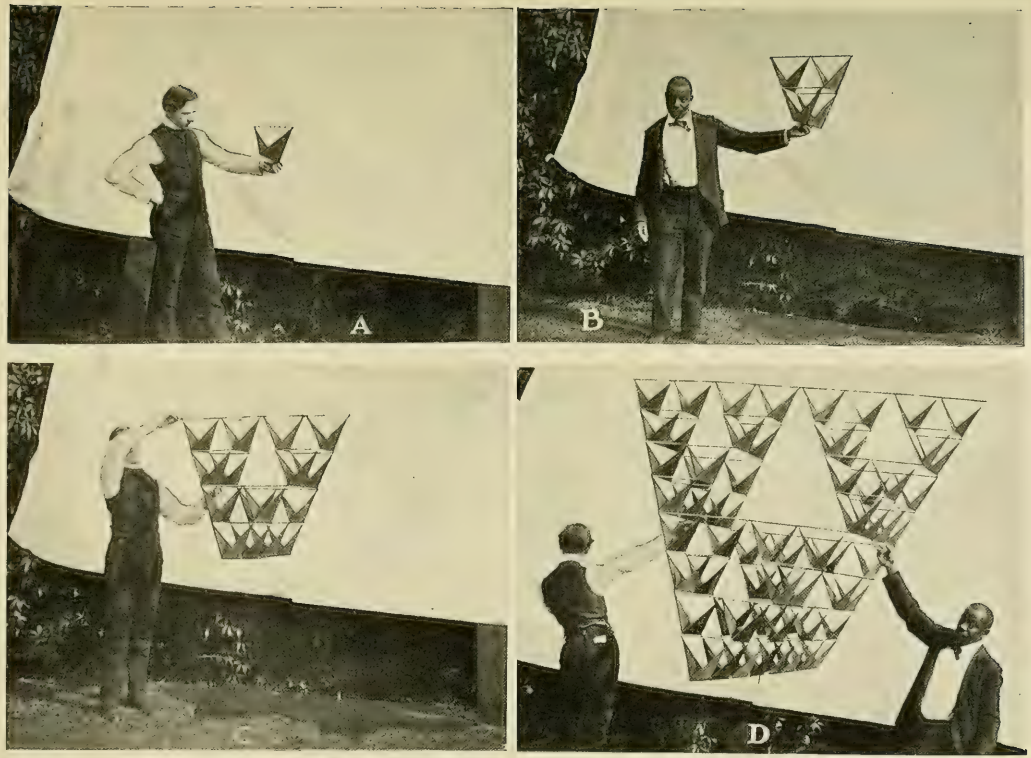
Four of these unit cells, connected together at their corners, form a four-celled structure having itself the form of a tetrahedron containing in the middle an empty space of octahedral form equal in volume to the four tetrahedral cells themselves (Fig. B, p. 13).

In my paper I showed that four of these four-celled structures connected at their corners resulted in a sixteen-celled structure of tetrahedral form containing, in addition to the octahedral spaces between the unit cells, a large central space equivalent in volume to four of the four-celled structures (Fig. C, p. 13).

In a similar manner four of the sixteen-celled structures connected together at their corners form a sixty-four-celled structure (Fig. D, p. 13).

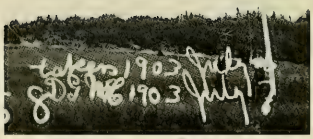
Four of the sixty-four-celled structures form a two hundred and fifty-six-celled structure, etc., and in each of these cases an empty space exists in the center equivalent to half of the cubical contents of the whole structure, in addition to spaces between the individual cells and minor groups of cells.

Kites so formed exhibit remarkable stability in the air under varying conditions of wind, and I stated in my paper that the kites which had the largest central spaces seemed to be the most stable in the air. Of course, these were the



A. Single-winged cell. B. Four-celled kite. C. Sixteen-celled kite. D. Sixty-four-celled kite

On this, the hollow plan of construction, an empty space appears in the middle of each kite, B, C, or D, equivalent in volume to one-half of the cubical contents of the whole structure



64-celled Tetrahedral Kite Flying from Flag-pole

Photograph by D. G. McCurdy

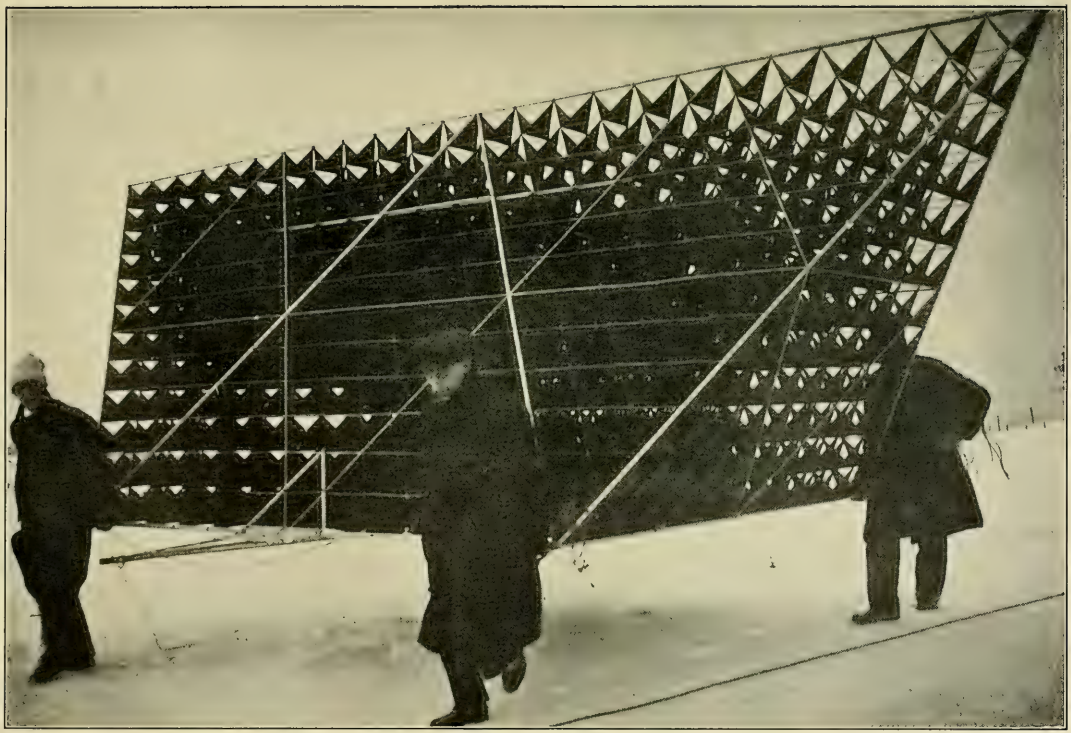
structures that were composed of the largest number of unit cells, and I now have reason to believe that the automatic stability of these kites depends more upon the number of unit cells than upon the presence of large empty spaces in the kites; for I have found, upon filling in these empty spaces with unit cells, that the flying qualities of a large kite have been greatly improved. The structure, so modified, seems to fly in as light a breeze as before, but with greatly increased lifting power, while the gain in structural strength is enormous.

I had hitherto supposed that if cells were placed directly behind one another without providing large spaces between them comparable to the space between the two cells of a Hargrave box kite, the front cells would shield the others from the action of the wind, and thus cause them to lose their efficiency; but no very marked effect of this kind has been observed in practice. Whatever theoretical interferences there may be, the detrimental effect upon the flying qualities of a kite are not, practically, obvious, while the gain in structural strength and in lifting power outweigh any disadvantages that may exist. I presume that there must be some limit to the number of cells that can be placed in close proximity to one another without detrimental effect, but so far my experiments have not revealed it.

EXPERIMENTS WITH "THE FROST KING"

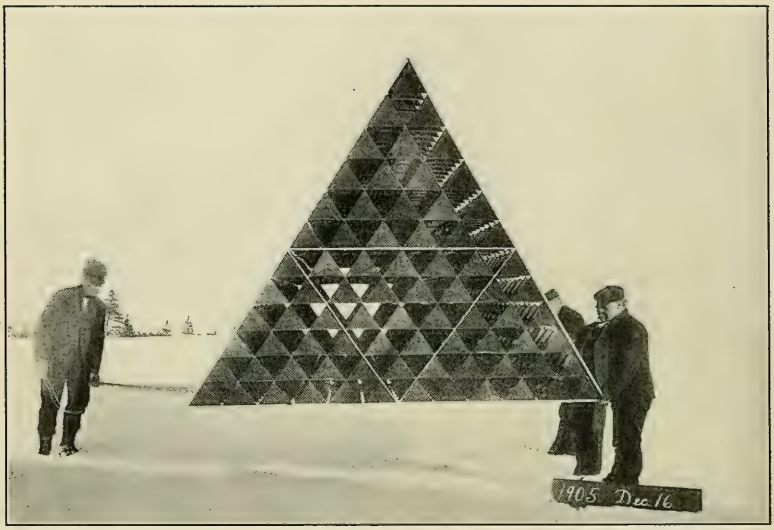
To test the matter, I put together into one structure all the available winged cells I had in the laboratory—1,300 in number. These were closely attached together, without any other empty spaces in the structure than those existing between the individual cells themselves when in contact at their corners.

The resulting kite, known as "The Frost King" (pages 15 and 16), consisted of successive layers or strata of cells closely superposed upon one another. The lowest layer, or floor of the structure, consisted of 12 rows of 13 cells each. The cells forming each row were placed side by side, attached to one another by their upper corners, and the 12 rows were placed one behind the other, the rear corners of one row being attached to the front corners of the row immediately behind. The next stratum above the floor had eleven rows of 14 cells; the next, 10 rows of 15 cells, etc., each successive layer increasing in lateral dimensions and diminishing in the fore-and-aft direction; so that the top layer, or roof, consisted of a single row of 24 cells placed side by side. One would imagine that a closely packed mass of cells of this kind, 1,300 in number, would have developed some difficulty in flying in a moderate breeze if the cells interfered with one another to any material extent; but this kite not only flew well in a breeze



Carrying the Frost King on to the Testing Ground

This kite was composed of 1,300 light winged cells closely massed together. Photograph by E. H. Cunningham



Side View of the Frost King, showing how closely the cells are massed together
Photograph by E. H. Cunningham

estimated at not more than about 10 miles an hour because it did not raise white caps, but carried up a rope ladder, several dangling ropes 10 and 12 meters long, and more than 200 meters of manilla rope used as flying lines, and, in addition to all this, supported a man in the air (page 17).

The whole kite, impedimenta and all, including the man, weighed about 131 kgs (288 pounds), and its greatest length from side to side was 6 meters at the top and three meters at the bottom. The sloping sides measured 3 meters, and the length from fore to aft at the square bottom was 3 meters. It is obvious that this kite might be extended laterally at the top to twice its length without forming an immoderately large structure. It would then be 12 meters on the top (39 feet) and 9 meters on the bottom from side to side, without changing the fore-and-aft dimensions or the height. It would then contain more than double the number of cells, and so should be able to sustain in the air more than double the load; so that such a structure would be quite capable of sustaining both a man and an engine of the weight of a man and yet be able to fly as a kite in a breeze no stronger than that which supported the "Frost King."

An engine of the weight of a man could certainly impart to the structure a velocity of 10 miles an hour, the estimated velocity of the supporting wind, and thus convert the kite into a free flying-machine. The low speed at which I have been aiming for safety's sake is therefore practicable.

HORIZONTAL AEROPLANES FOUND UNSTABLE

In the "Frost King" and other kites composed exclusively of tetrahedral winged cells there are no horizontal sur-

The Frost King in the Air, Flying in a Ten-mile Breeze, and Supporting a Man on the Flying Rope

During the experiment the rope straightened under the pull of the kite, and the man was raised to a height of 30 or 40 feet. He was in great peril, but fortunately was brought down safely. Photograph by Alexander Graham Bell

faces (or rather surfaces substantially horizontal, as in ordinary kites), but the framework is admirably adapted for the support of such surfaces. Horizontal aëroplanes have much greater supporting power than similar surfaces obliquely arranged, and I have made many experiments to combine horizontal surfaces with winged cells with greatly improved results, so far as lifting power is concerned. But there is always an element of instability in a horizontal aëroplane, especially if it is of large size, whereas kites composed exclusively of winged cells are wonderfully steady in the air under varying conditions, though deficient in lifting power; and the kites composed of the largest number of winged cells seem to be the most stable in the air.

In the case of an aëroplane of any kind the center of air pressure rarely coincides with the geometrical center of surface, but is usually nearer the front edge than the middle. It is liable to shift its position, at the most unexpected times, on account of some change in the inclination of the surface or the direction of the wind. The change is usually small in steady winds, but in unsteady winds great and sudden changes often occur.

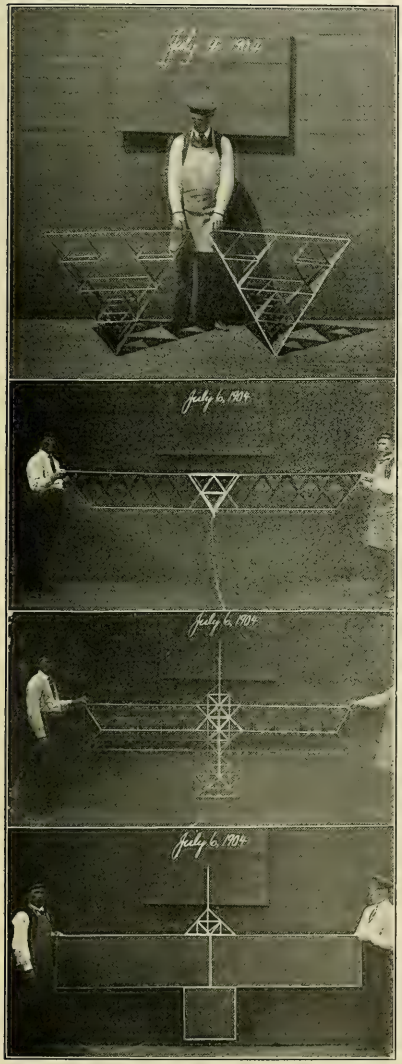
The extreme possible range of fluctuation is of course, from the extreme front of the aëroplane to the rear, or *vice versa*, and the possible amount of change, therefore, depends upon the dimensions of the aëroplane, especially in the fore-and-aft direction. With a large aëroplane the center of pressure may suddenly change to such an extent as to endanger the equilibrium of the whole machine, whereas with smaller aëroplanes, especially those having slight extension in the fore-and-aft direction, the change, though proportionally as great, is small in absolute amount. Where we have a multitude of small surfaces well separated from one another, as in the tetrahedral construction, it is probable that the resultant center of pressure for the whole kite can shift to no greater extent than the centers of pressure of the individual surfaces themselves. It is, therefore, extremely unlikely that the equilibrium of a large kite could be endangered by the shifting of the centers of pressure in small surfaces within the kite. This may be the cause of the automatic stability of large structures built of small tetrahedral cells. If so, one principle of stability would be: *Small surfaces, well separated, and many of them.* The converse proposition would then hold true if we desired to produce instability and a tendency to upset in a squall, namely: *Large surfaces, continuous, and few of them.*

HARGRAVE BOX KITES AND TETRAHEDRAL KITES COMPARED

Another source of danger with large continuous surfaces is the fact that a sudden squall may strike the kite on one side, lifting it up at that side and tending to upset it; but the compound tetrahedral structure is so porous that a squall passes right through and lifts the other side as well as the side first struck; so that the kite has not time to be upset before the blow on one side is counterbalanced by a blow on the other. I have flown a Hargrave box kite simultaneously with a large kite of many tetrahedral cells in squally weather for the purpose of comparing them under similar conditions. The tetrahedral structure often seemed to shiver when struck by a sudden squall, whereas the box kite seemed to be liable to a swaying or tipping motion that would be exceedingly dangerous in a structure of large size forming part of a flying-machine.

Another element of stability in the tetrahedral structure lies in the fact that the winged surfaces are elevated at a greater angle above the horizon than 45°.

Supposing the wings of a cell to be opened out until they are nearly flat, or at least until they each make a comparatively small angle with the horizon—say 20°—then, if from any cause the cell should tip so as to elevate one wing (say to 25°) and depress the other (say to 15°), the lifting power of the wind will be increased upon the elevated wing and diminished on the depressed wing;



1. Two 16-celled Tetrahedral Kites, the one on the right protected by a beading of wood around the outer edges. 2, 3, 4. Oionos Kite with fixed tail. 2 Front view. 3. Bottom view. 4. Top view

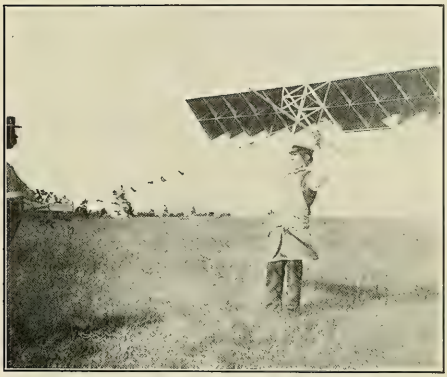
so that there would be no tendency to a recovery of position, but the very reverse. The pressure of the wind would tend to increase the tipping action and favor the production of oscillation and a tendency to upset. The lifting power of the wind upon a surface inclined at 10° is less than at 20°, and greater at 25° than 20°. The more the wings are opened out and the flatter they become, the more essentially unstable is the arrangement in the air.

Now suppose the wings to be raised until they are nearly closed, or at all events till they make a small angle with the vertical (say 70° from the horizontal), then, if from any cause the cell should tip so as to elevate one wing (say to 75°) and depress the other (say to 65°), the lifting power of the wind will be increased upon the depressed wing and diminished on the elevated wing; for the lifting power of the wind is greater at 65° than at 70° and less at 75°. Thus the moment a tipping action begins the pressure of the wind resists it, and an active force is invoked tending to restore the structure to its normal position. The more the wings are raised and the more they approach the perpendicular position, the more stable essentially is the arrangement in the air.

The dividing line between these two opposite conditions seems to be drawn about the angle of 45°. As the tetrahedral wing surfaces make a greater angle than this with the horizontal, they constitute an essentially stable arrangement in the air, whereas a horizontal surface represents the extreme of the undesirable unstable condition.

AUTOMATIC STABILITY

These considerations have led me to prefer a structure composed of winged tetrahedral cells alone, without horizontal surfaces either large or small, although the lifting power is less than when horizontal surfaces are employed, because the factor of safety is greater. One of the chief causes that have led to disasters in the past has been a lack of stability in the air. Automatic stability under varying conditions is surely of the very first consequence to safety, for

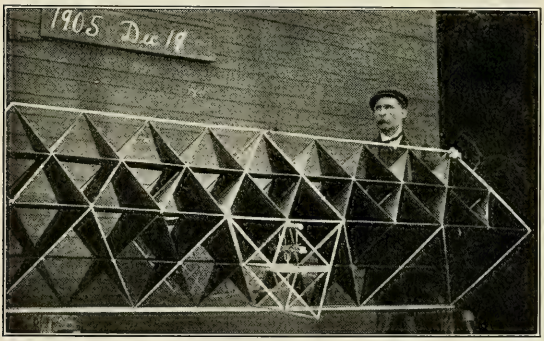


Method of Flying the Oionos Kite

Pieces of red silk are attached to several meters of the flying cord with the object of rendering the direction of the cord visible on the photograph plate

what would it profit a man were he to gain the whole world and lose his own equilibrium in the air? A kite composed exclusively of multitudinous winged cells seems to possess this property of automatic stability in a very marked degree. If, then, its lifting power is sufficient for our purpose, there is no necessity for the introduction of a factor of danger by the addition of horizontal surfaces. Of course, the addition of such surfaces would enable us to secure the desired lifting power with a smaller, and therefore lighter, structure, and this would be of advantage if we could be sure of its stability in the air.

In employing tetrahedral winged cells alone upon the hollow plan of construction in which large empty spaces occurred within the kite, a practical difficulty was encountered arising from the enormous size of the structure required for the support of a man, combined with the increasing weakness of the structure as it increased in size. The discovery that the cells may be closely massed together without marked injurious effects has completely remedied this difficulty; for upon this plan not only is the structural strength improved by an increase of size, but the lifting power increases with the cube of the dimensions; so that a very slight increase in the dimensions of a



Oionos Kite with Movable Tail Controlled by Swinging Head-load of Lead

When released in the air at a considerable elevation it acts very much like a soaring bird, moving forward against the wind or swinging around in large circles. It is then, in effect, a free gliding machine, which acquires considerable velocity in the horizontal direction, while descending gently in the vertical direction. The head-load gives the machine a slight tendency to dive, which is resisted by the steering action of the tail when headway is gained. The moment the head is depressed, as in diving, the weight swings forward, thus automatically causing the elevation of the tail

large kite increases very greatly its lifting power. We now have the possibility of building structures composed exclusively of tetrahedral winged cells that will support a man and an engine in a breeze of moderate velocity without the necessity of constructing a kite of immoderate size. The experiments with the "Frost King" made in December, 1905, satisfied me upon this point and brought to a close my experiments with kites.

CONCLUSION

Since December, 1905, my attention has been directed to other points necessary to be considered before an aërodrome of the kite variety can be made, and to the assembling of the materials for its manufacture.

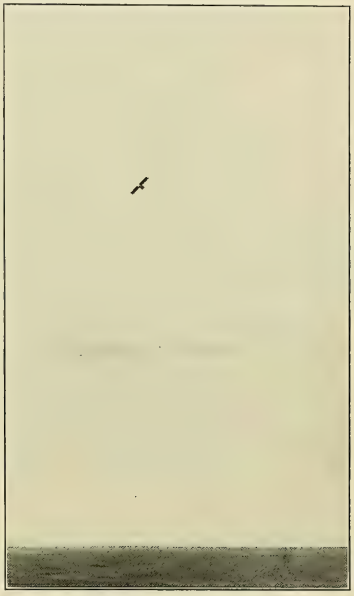
I have had to improve and simplify the method of making the winged cells themselves. Through the agency of Mr Hector P. McNeil, superintendent of the Volta laboratory, Washington, D. C., who is now taking up the manufacture of tetrahedral cells as a new business, I am now able to obtain cells constructed largely by machinery, and with stamped metal corners to hold the rods together. The process of tying the cells and parts of cells together had proved to be very laborious and expensive, and the process was not suited to unskilled persons. By the new process most of the work is done by machinery, and no skill is required to connect the cells together.

I have also had to go into the question of motor construction—a subject with which I am not familar—and while waiting for the completion of the material required for the aërodrome I have been carrying on experiments to test the relative efficiency of various forms of aërial propellers.

I have also been occupied with the details of construction of a supporting float adapted for propulsion over the water as a motor boat and also adapted to form the body of the flying-machine when in the air.

BOATS DRIVEN BY AERIAL PROPELLERS

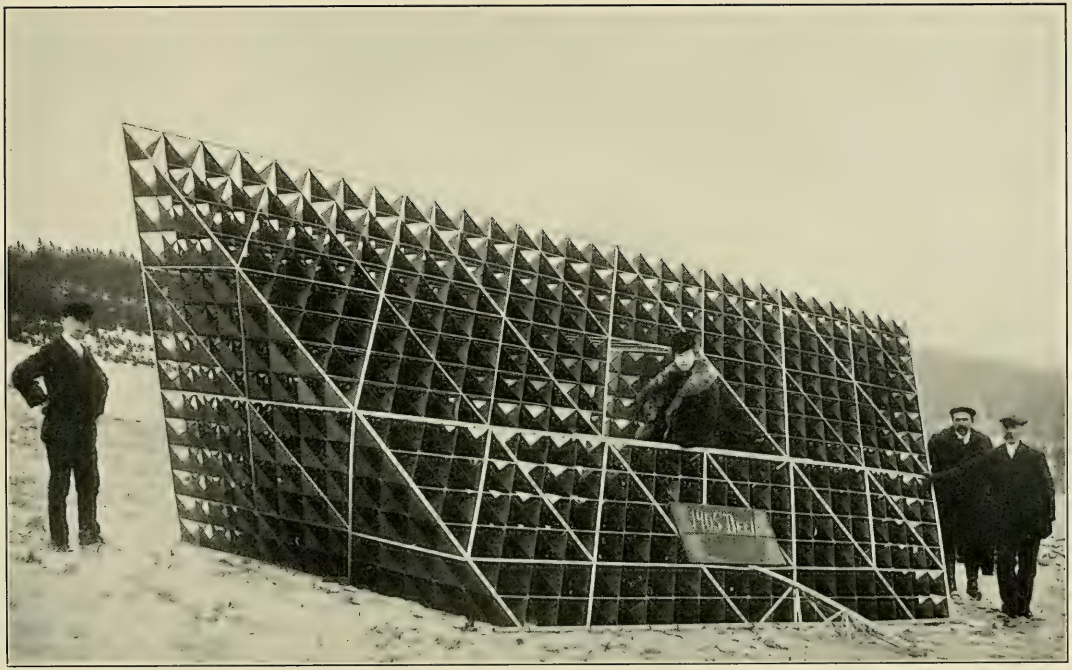
Of course, it would be premature for me to enter into any description of experiments that are still in progress, or to submit plans for an aërodrome which are still under discussion. I shall therefore simply say, in conclusion, that I have



"Oionos" Kite in the Air

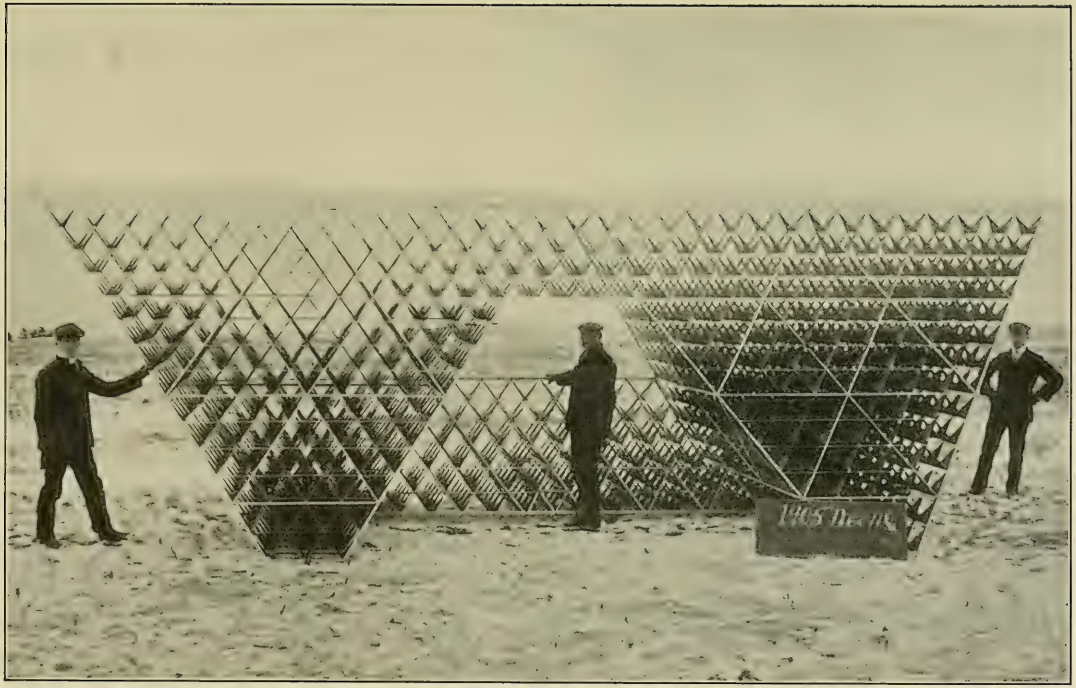
This name was applied by the ancient Greeks to the great solitary soaring birds, from which they drew their auguries

recently been making experiments in propelling, by means of aërial propellers, a life-raft supported, catamaran fashion, on two metallic cylinders. The whole arrangement, with a marine motor on board, is exceedingly heavy, weighing over 2,500 pounds, and it is sunk so low



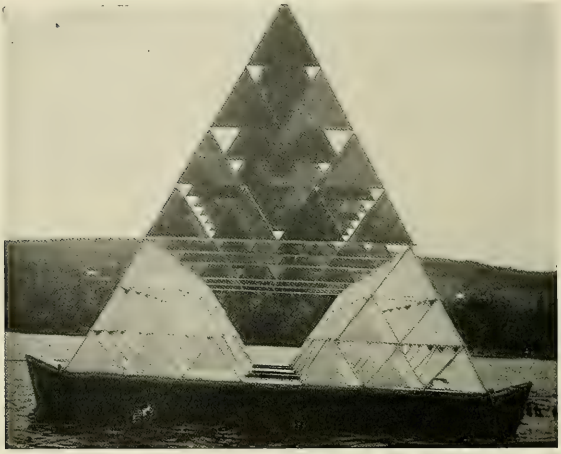
Kite "Siamese Twins" Seen from the Front

This kite was supported in the air by a strong wind exceeding, probably, 25 miles an hour. It was too heavy to be flown in a moderate breeze



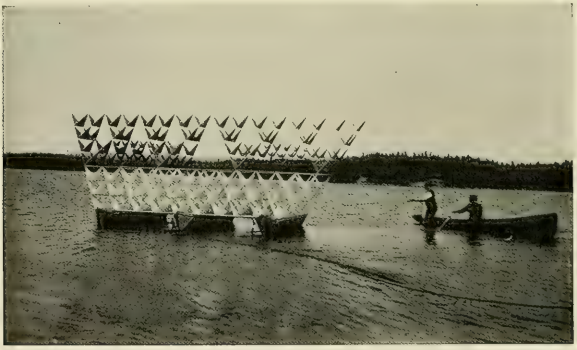
Kite "Siamese Twins," Seen from the Rear, Looking Inside Kite

Composed of two distinct kites connected by a bridge, or truss, of strong cells, well beaded, for support of man



Side View of Mabel II

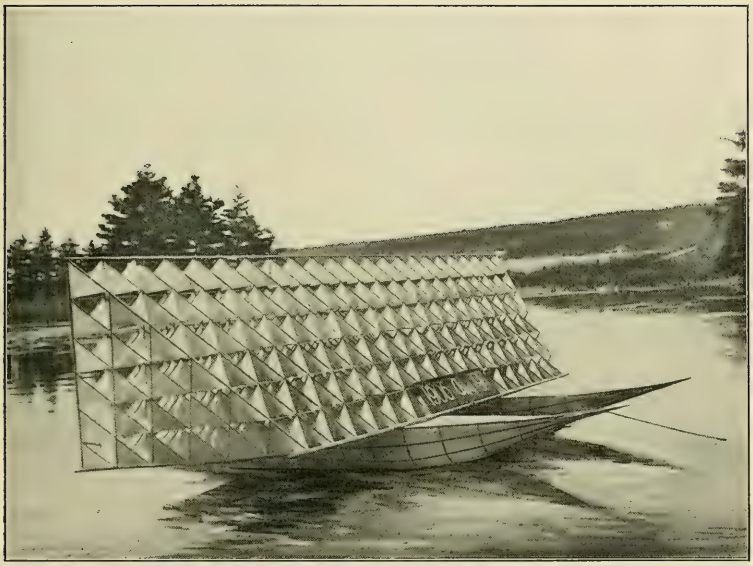
A floating kite supported upon three boat-like floats formed of tetrahedral cells and covered completely with oil-cloth. In September, 1903, this kite was raised into the air by being towed by a steamboat against the wind



Photos by Gilbert H. Grosvenor

Mabel II Outlined against Sky showing Bird-wing Effect

For experiments with this kite see "The Tetrahedral Kites of Dr Alexander Graham Bell," by Gilbert H. Grosvenor, *Popular Science Monthly*, December, 1903



A Floating Kite, adapted to be Towed Out of the Water

Kite consists of a bridge, or truss, of tetrahedral cells with wings of Japanese waterproof paper upon two floats of light framework covered with oilcloth. A stout towing pole extends laterally across the lower part of the wing-piece at the front. Photograph by Douglas McCurdy

that the water level rises at least to the middle of the supporting cylinders, so that the raft is not at all adapted for propulsion and cannot attain great speed. The great and unnecessary weight of this machine has led to an interesting and perhaps important discovery that might have escaped attention had the apparatus been lighter and better adapted for propulsion (page 26).

Under the action of her aërial propellers, this clumsy raft is unable to attain a higher speed than four miles an hour; and yet she is able to face a sixteen-mile white-cap breeze and make headway against it, instead of drifting backward with the wind. Under such circumstances her speed is materially reduced; but the point I would direct attention to is this: that she is not stopped by a current of air moving with very much greater velocity than her maximum possible speed in a calm. Of course, there would be nothing remarkable about this if her propellers were acting in the water instead of the air; but they were not. They acted exclusively in the air, and the water was only an additional resistance to be overcome.

It is worthy of note in this connection that the rapid rotation of the propellers yield a theoretical efficiency of thirty or forty miles an hour, and that the mass of the machine and the resistance of the water drag this down to an actual performance of only four miles; so that at first sight it appears probable that the effect noted may be a result of the

"The Ugly Duckling"

A raft supported upon metallic cylinders and propelled by aërial propellers. Above illustration shows raft propelled by small gasoline motor. In subsequent experiments referred to in the text, the bridge, or truss, supporting the propellers was raised considerably above the level of the platform, and the engine employed was a four-cylinder water-cooled marine motor weighing 650 pounds. This caused the metallic floats to be sunk to their middle points; but the floats were not connected together at their ends, as shown above

greater slip of the propellers acting in a calm. I am inclined to think, however, that this explanation is insufficient, and would suggest the following as more probable:

The enormous mass of the moving body enables it to acquire very considerable momentum with slight velocity, whereas the opposing current of air has such slight mass that it cannot acquire an equal momentum with a very much higher velocity.

If two bodies of unequal mass, moving with equal but opposite velocities, come into collision with one another, then the heavier body will not be completely stopped by the lighter. It will make headway against the resistance of the other, even though the lighter should possess superior velocity, provided, of course, that it has a sufficient superiority of mass. We are here dealing with momentum (mv), not velocity (v) alone. The body having the greatest momentum will be the victor in the struggle, whatever the actual velocities may be.

The suggestiveness of this result lies in its application to the flying-machine problem. A balloon, on account of its slight specific gravity, must ever be at the mercy of the wind. In order to make any headway against a current of air, it must itself acquire a velocity superior to the wind that opposes it. On the other hand, it is probable that a flying-machine of the heavier-than-air type, at whatever speed it moves, will be able to make headway against a wind of much greater velocity, provided its momentum is greater than the momentum of the air that opposes it.

APPENDIX A

DETAILS CONCERNING THE KITE "FROST KING"

Number of Cells in the "Frost King"

Layers of cells.	Number of rows.	Number of cells in each row.	Number of cells in each layer.
1st layer	1	24	24
2d layer	2	23	46
3d layer	3	22	66
4th layer	4	21	84
5th layer	5	20	100
6th layer	6	19	114
7th layer	7	18	126
8th layer	8	17	136
9th layer	9	16	144
10th layer	10	15	150
11th layer	11	14	154
12th layer	12	13	156
Total number of cells			1,300

Dimensions.—Each cell had a side of 25 centimeters, so that the roof, or ridge-pole, measured 6 meters, extending laterally across the top of the structure. The oblique sides were 3 meters in length, and the bottom, or floor, formed a square having a side of 3 meters. The whole structure constituted a section of a tetrahedral kite—the upper half, in fact, of a kite having the form of a regular tetrahedron with a side of 6 meters.

Weight.—The winged cells composing this structure weighed on the average 13.84 gms. apiece, so that the whole cellular part of the structure which supported all the rest, consisting of 1,300 winged cells, weighed 17,992 gms.

In addition to this, the kite carried as dead load stout sticks of wood, which were run through the structure to distribute the strain of the pull upon the strong parts of the framework—that is, upon the junction points of the cells. The outside edge of the kite was also protected by a beading of wood. The whole strengthening material weighed 9,702 gms., and the kite as a whole weighed 27,694 gms. (61 lbs.).

Surface.—I estimate the surface of an equilateral triangle having a side of 25 centimeters as about 270.75 square centimeters; in which case the silk surface of a single winged cell consisting of two triangles amounts to 541.5 square centimeters, and the actual silk surface employed in 1,300 cells equals 70.3950 square meters (757.7 sq. ft.).

The surfaces are all oblique, and if we resolve the oblique surfaces into horizontal and vertical equivalents (supporting surfaces and steadying surfaces) we find that the resolved horizontal equivalent (supporting surface) of a single winged cell forms a square of which the diagonal measures 25 centimeters, and this is equivalent to a rectangular parallelogram of 25 x 12.5 centimeters, having an area of 312.5 square centimeters.

Thus an actual silk surface of 541.5 square centimeters arranged as the two wings of a winged cell yields a supporting surface of 312.5 square centimeters.

In kites, therefore, composed exclusively of tetrahedral winged cells each having a side of 25 centimeters, the area of supporting surface bears the same proportion to the actual surface as the numbers 3,125 to 5,415; or 1 to 1.7328.

$$\frac{\text{Supporting surface}}{\text{Actual surface}} = \frac{1}{1.7328}$$

A simple way of calculating the amount of supporting surface in such structures is to remember that there are 32 cells to the square meter of supporting surface; therefore the 1,300 cells of the kite "Frost King" had a supporting surface of 40.6250 square meters (437.3 sq. ft.).

Ratio of Weight to Surface.—The actual silk surface employed in the "Frost King" was 70.3950 square meters (757.7 sq. ft.), the weight of the kite was 27,694 gms. (61 lbs); so that on the basis of the actual surface, the flying weight was 393.4 gms. per square meter (0.08 lbs. per sq. ft.).

But, for the purpose of comparing the flying weight of a tetrahedral kite with that of other kites, in which it is usual to estimate only the aëroplane surfaces that are substantially in a horizontal plane, it would be well to consider the ratio of weight to horizontal or supporting surface in this kite.

The weight was 27,694 gms. (61 lbs.), the resolved horizontal or supporting surface was equivalent to 40.6250 square meters (437.3 sq. ft.), and the flying weight for comparison with other kites was 681.7 gms. per square meter of supporting surface (0.14 lbs. per sq. ft.).

The kite, in addition to its own weight, carried up a mass of dangling ropes and a rope-ladder, as well as two flying cords of manilla rope. The impedimenta of this kind weighed 28,148 gms. (62 lbs.). It also supported a man, Mr Neil McDermid, who hung on to the main flying rope at such a distance from the cleat attached to the ground that when the rope straightened under the strain of the kite he was carried up into the air to a height of about 10 meters (over 30 ft.). The weight of this man was 74,910 gms. (about 165 lbs.). Thus the total load carried by the kite, exclusive of its own weight, was 103,058 gms. (or 227 lbs.).

The whole kite, load and all, including the man, therefore, weighed 130,752 gms. (288 lbs.), and its flying weight was 1,857.4 gms. per square meter of actual surface (0.38 lbs. per sq. ft.), or 3,218.5 gms. per square meter of supporting surface (0.66 lbs. per sq. ft.).

A. G. B.

APPENDIX B

Partial Bibliography Relating to Aerial Locomotion, Prepared, through the Courtesy of the Smithsonian Institution, by Dr Cyrus Adler, Assistant Secretary, in Charge of Library and Exchanges.

Dr Adler says:

"In accordance with your request, I am authorized to send you herewith a list of the writings of S. P. Langley, Octave Chanute, Otto Lilienthal, Lawrence Hargrave, and A. M. Herring, to be used in connection with your recent paper on aerial locomotion. I ought to explain that, excepting in the case of Mr Langley's writings, I am not at all sure that the lists are complete, since the time afforded for bringing together the references was very short, and of course there may be publications in out-of-the-way journals which would only be revealed by a more extended inquiry. I have also appended a list of papers on the subject published by the Smithsonian Institution, as the Smithsonian publications are accessible in all libraries throughout the country, whereas many of the publications cited in the other lists are not readily to be found."

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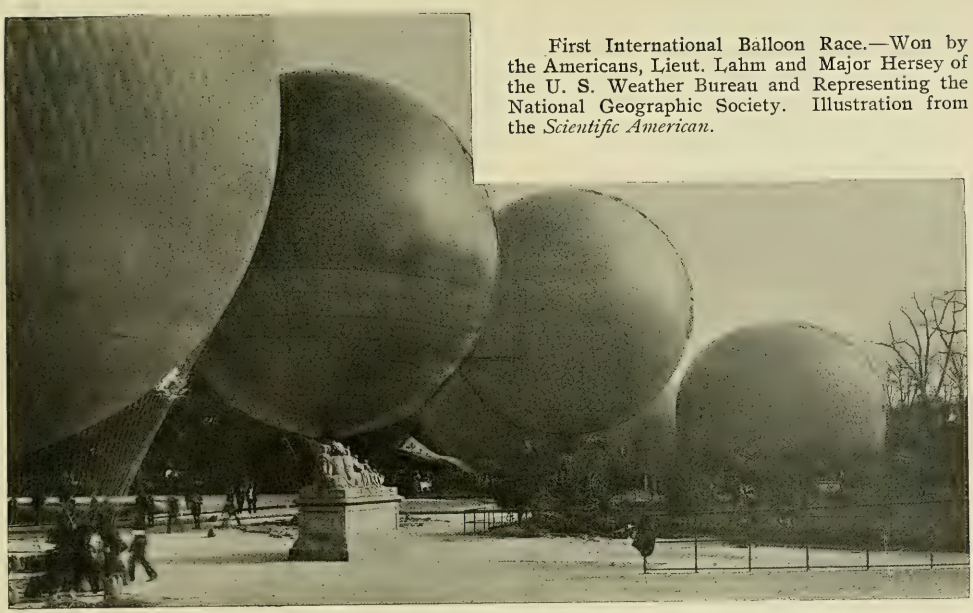
(Continued on page 33)

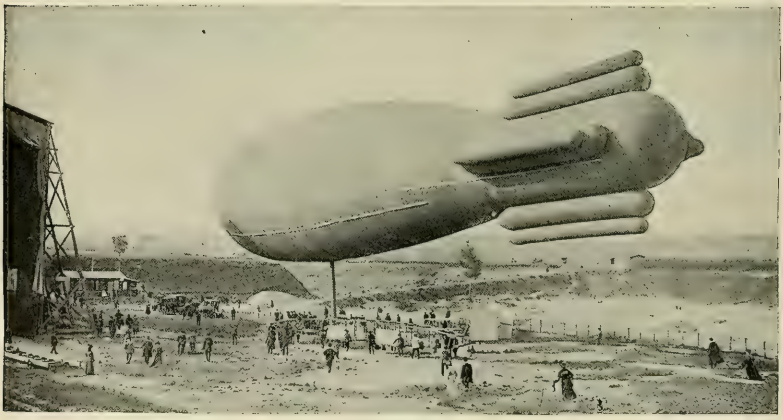


First International Balloon Race.—Won by the Americans, Lieut. Lahm and Major Hersey of the U. S. Weather Bureau and Representing the National Geographic Society. Illustration from the *Scientific American*.

Some of the Balloons Which Took Part in the Great Race for the Gordon Bennett Cup

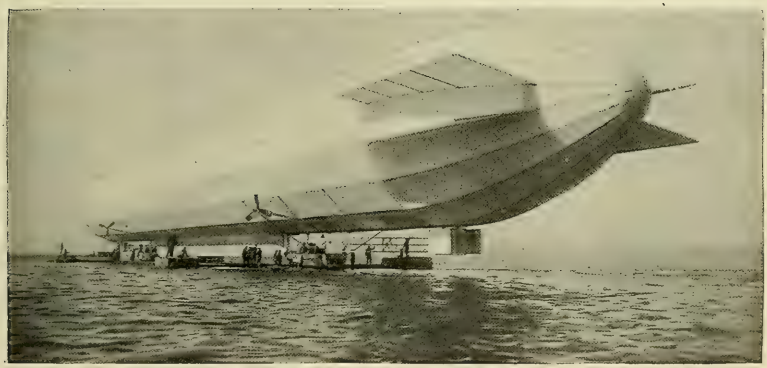
The French Military Dirigible, "Patrie," in Flight

The latest French airship, "La Patrie," is 33¾ feet in diameter by 196 feet long, and has a capacity of 111,195 cubic feet. Driven by a 70-horsepower motor and two propellers, this dirigible has recently made about 30 miles an hour. Its lifting capacity is 2,777 pounds. Illustration from the *Scientific American*



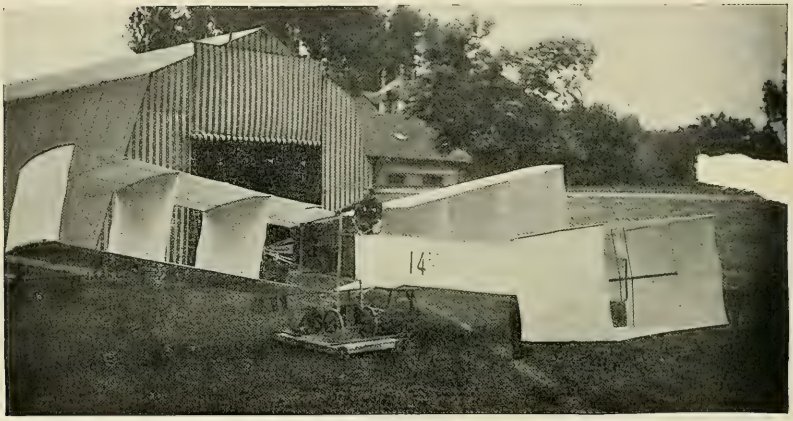
The New Deutsch Airship "Ville de Paris," a Strange Looking Dirigible Balloon

The peculiar arrangement of twin, hydrogen-filled cylinders forms a sort of balancing tail. This airship has a length of 60 meters (196.85 feet) and a diameter of 10.8 meters (35.43 feet), while its capacity is 3,000 cubic meters (105,943 cubic feet). Its propellers are placed on either side of the body framework or "nacelle," and at about the center of the latter, which is boat-shaped. The weight which can be carried, outside of the equipment and the fuel sufficient for a ten hours' run, is about 1,100 pounds. A 70-horsepower Panhard motor is used. Illustration from the *Scientific American*



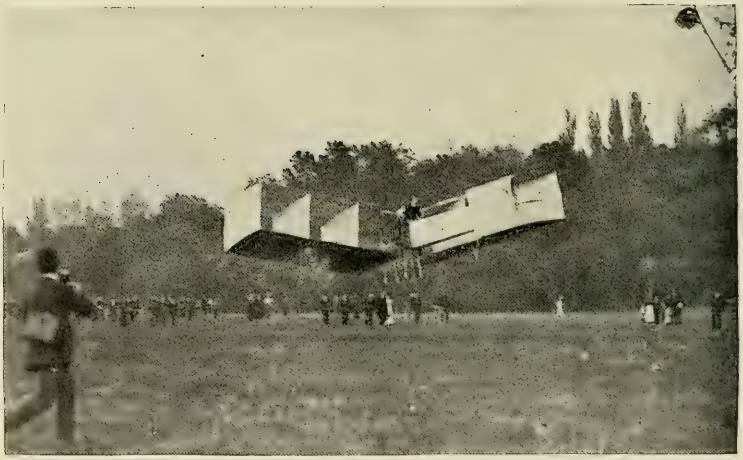
Count Von Zeppelin's Airship—the Largest and Fastest Thus Far Constructed—Coming Out of Its Shed and Performing Various Evolutions Above Lake Constance

This airship, which is 38 feet in diameter by 410 feet in length and which has a capacity of 367,120 cubic feet, held itself stationary against a 33½-mile-an-hour wind on January last, by means of two 35-horsepower gasoline motors driving four propellers. The airship can lift three tons additional to its own weight, which gives it a radius of 3,000 miles at 31 miles an hour. On October 11, 1906, Count Zeppelin maneuvered this dirigible balloon above Lake Geneva, ascending to a height of 2,500 feet and steering the huge cigar-shaped aërostat very nicely. The airship is mounted on floats, so that it works equally well on the water. During one flight it remained in the air an hour and twenty minutes, although the steering-gear was caught in the skeleton framework and became partly unmanageable. The attempts proved also that the airship was dirigible in spite of its great size, as several complete circles were made while in the air. Illustrations from the *Scientific American*



Santos-Dumont's Aëroplane

The inventor is seated on top of the basket, just ahead of the motor



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	Glaisher, James	An Account of Balloon Ascensions.....	Report, 1863.
789	Wenham, F. H.....	On Aerial Locomotion.....	Report, 1889.
801	Langley, S. P.....	Experiments in Aerodynamics.....	Cont. to Knowledge.
884	Langley, S. P.....	The Internal Work of the Wind.....	Cont. to Knowledge.
938	Lilienthal, Otto	The Problem of Flying and Practical Experiments in Soaring.	Report, 1893.
1134	Langley, S. P.....	Story of Experiments in Mechanical Flight..	Report, 1897.
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1149	.....	Letters from the Andree Party.....	Report, 1897.
1197	Bacon, John M.....	Scientific Ballooning	Report, 1898.
1248	.....	Count Von Zeppelin's Dirigible Air Ship.....	Report, 1899.
1267	Janssen, J.	The Progress of Aeronautics.....	Report, 1900.
1268	.....	Lord Rayleigh on Flight.....	Report, 1900.
1269	.....	The Langley Aerodrome. (Note prepared for the conversazione of the Amer. Inst. of Elec. Engineers, New York City, April 12, 1901.)	Report, 1900.
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1380	Wright, Wilbur	Some Aeronautical Experiments.....	Report, 1902.
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1494	Baden-Powell, Maj. B.	Progress with Air Ships.....	Report, 1903.
1495	Chanute, O.	Aerial Navigation	Report, 1903.
1496		Graham Bell's Tetrahedral Kites.....	Report, 1903.
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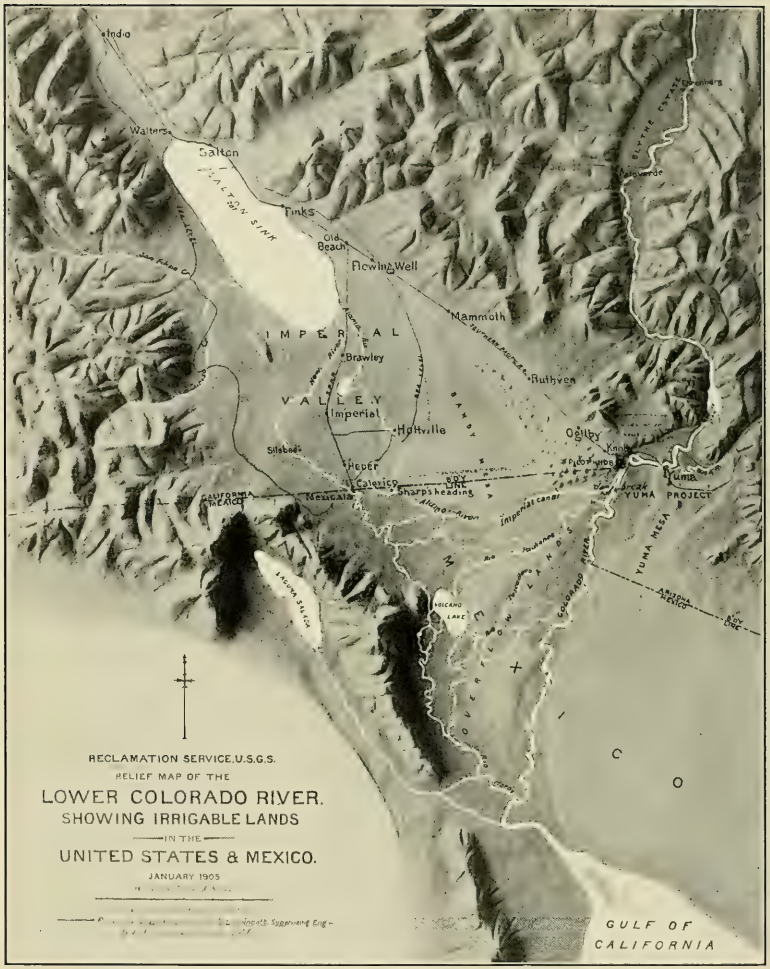
A Flock of Angora Goats in Our New State—Oklahoma



The Great New Lake Rising in the Salton Sink

The Colorado River is now flowing through the Imperial Canal into the Alamo River. Nine-tenths of the water leaves the Alamo River, however, at a point a few miles south of Sharp's Heading and rushes into the New River, and thence down into Salton Sink. Before this break occurred the Alamo and New Rivers were barely perceptible channels, filled with sand and sediment, and only occasionally carrying water. As the Salton Sink is nearly 300 feet below sea-level, the descending torrent has dug deep channels in the Alamo and New Rivers. These channels are preceded by huge cataracts, which are rapidly eating their way back and leaving the towns and canals without water. On November 4, 1906, a dam over 500 feet long was completed below Pilot Knob, which turned the river back into its old channel to the Gulf of California, but several weeks later the water worked its way around the dam, and the entire river is once more rushing down to the Salton Sink. The cataract in the New River is now rapidly approaching the Alamo, and if it once joins the Alamo, the Imperial Valley farms will be left high and dry until they are inundated by the rising Salton Lake

THE NEW INLAND SEA*

By Mr Arthur P. Davis

Assistant Chief Engineer, U. S. Reclamation Service

MANY centuries ago the Gulf of California extended to a point about 150 miles northwestward from its present head. It also extended up the present valley of the Colorado River at least to Yuma and probably somewhat above. The Colorado River, rising in the Wind River Mountains of Wyoming and the Rocky Mountains of Colorado, carved the rocks along its course and brought the resulting sands and mud down in its swift current, discharging them into the arm of the gulf near Yuma. As this process went on, without cessation, century after century, the valley was gradually filled, a delta built up, over which the river flowed far out into the gulf. It encroached progressively upon the shores of the gulf until it built up a delta entirely across, joining the foothills of the Cocopah Mountains on the western shore. This cut off the head of the gulf, and the arid climate rapidly evaporated the waters thus separated and left an inland depression, which at its lowest point was nearly 300 feet below sea-level.†

The river continued to bring down its load of sediment and to build its delta higher and force it farther into the gulf. Like all such deltaic streams, the channel on the top of the delta is constantly shifting, cutting one bank, building up the other, overflowing both banks, and during high water sometimes entirely abandoning an old channel for a new one. In this way the river has from time to time flowed into the Salton Sea for some years or centuries, and anon has shifted to the eastward and discharged again into the gulf. This is the general course the river has followed ever since its discovery by the Spaniards in the 16th century. At high water the river normally overflows its banks in the valley regions all the way from the Grand Canyon to the Gulf of California. In unusually high water, such as occurred in 1891, the overflow running into the Salton Sink has been sufficient to materially raise the level of the lake and overflow the tracks of the Southern Pacific Railway, which are built along its shores.

THE IRRIGATING COMPANY RESPONSIBLE FOR THE BREAK

The ease of diverting the Colorado River near the international line and conducting the water through natural channels to the Colorado Desert for irrigation has been recognized for many years, and various attempts to promote this project have been made from time to time, usually, however, without success, owing to the international complications involved.

About 1891 Mr C. R. Rockwood, a civil engineer, made plans for the construction of a headgate in rock at the foot of Pilot Knob, just north of the Mexican line, and of a canal to carry the water to the so-called Alamo River, an ancient channel of the Colorado which, by lapse of centuries, had been nearly filled with sand and sediment. Efforts to promote this project were for nearly 10 years unsuccessful, but finally a small amount of money was raised, which, however, was insufficient for the construction of the works as planned. The promoters then concluded simply to cut the dirt banks of the river and lead the water by a small canal into an old channel, whence it flowed into the Imperial Valley without additional construction. A cheap wooden headgate was built in the canal near the river and was for a

* An address to the National Geographic Society, November 23, 1906.

† It is estimated that the amount of silt carried by the Lower Colorado River is sufficient to cover 53 square miles one foot deep with dry alluvial soil each year.

time used in the control of the waters. The water was diverted from the Alamo channel at a point called Sharp's Heading, just below the Mexican line, in the southern edge of the Imperial Valley. The water was led by canals over the land to be irrigated and settlement began.

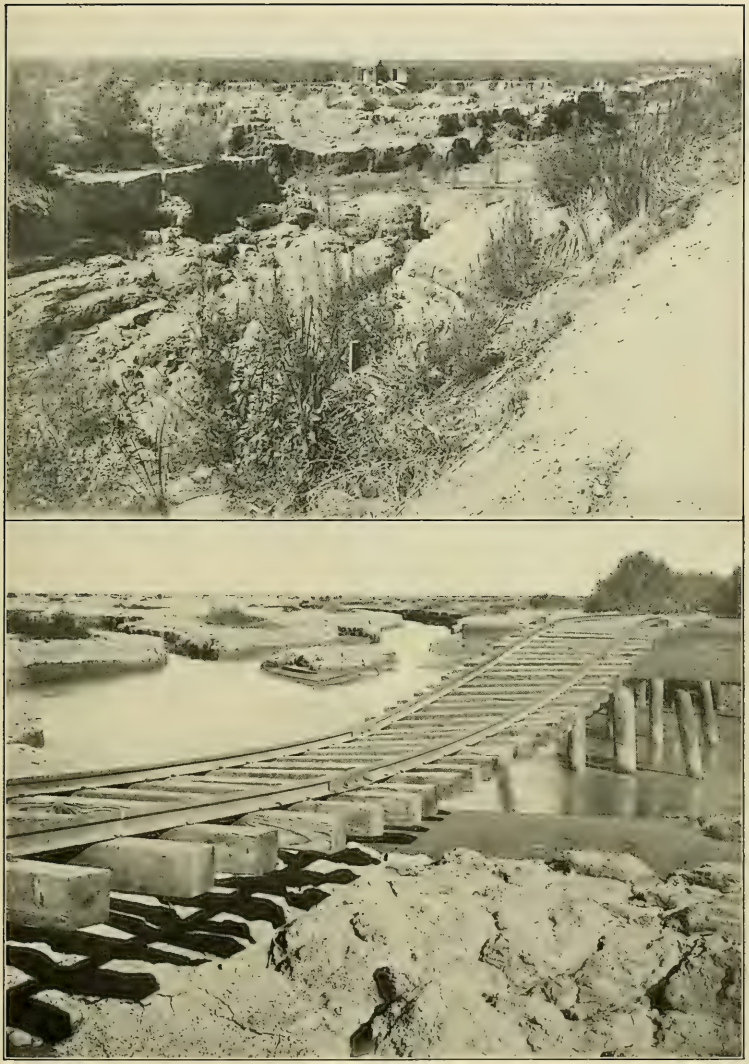
The headquarters of the irrigation company were established at a town called Calexico, adjoining the Mexican line, this name being derived by substituting the first syllable of the word "California" for the first letter of "Mexico." Settlers gradually came in and, the valley proving to be very fertile, development proceeded apace. As the demand for water became greater, however, the supply became less. The muddy waters of the Colorado River, checked by their entrance into the artificial channel, and still further checked by the obstruction of the headgate, deposited their load of mud, and constant effort was necessary to keep the heading open. The unsuccessful attempts to maintain the canal heading led to its abandonment and to the cutting of a new one near by in which no headgates were provided. This gave somewhat less trouble, but it, too, gradually began to fill and the effort at maintenance had to be continued. Several new headings were cut for the same reason, and serious losses occurred in the Imperial Valley from shortage of water during the time when most needed, owing to the difficulty of getting sufficient water into the head of the canal.

After repeated failures of the effort to maintain an open canal heading, the company finally went to a point about four miles below the Mexican line, where a greater declivity from the river bank could be obtained in a shorter distance, and there cut a large channel, with the idea of obtaining a sufficient velocity of water to prevent the deposit of sediment in the canal heading. In this respect the attempt proved successful, and throughout the low-water season of 1904-05, which occurs in winter, a large supply of water was furnished through this channel, sufficient for the irrigation of about 75,000 acres of land, most of which was under cultivation in the Imperial Valley. The Southern Pacific Railroad built a branch road from Old Beach through Brawley, Imperial, and Holtville to Calexico, and began building through Mexican territory from Calexico to Yuma, intending to make this the main line and cut out some heavy grades now encountered between Pilot Knob and Yuma.

THE BREAK OF JUNE, 1905

The large new heading in Mexico maintained itself without silting throughout the low-water season, but when the annual flood of May arrived the larger volume of water and the consequent increase in velocity began cutting the channel, and in June it was found that the volume of water running toward the Imperial Valley was many times that required for irrigation and was rapidly cutting the channel wider and deeper. By the end of August, 1905, the majority of the water of the Colorado River was flowing toward the westward instead of the south, and the Salton Sea was rapidly rising and submerging portions of the Southern Pacific Railroad track, which were hurriedly moved to higher ground.

The distance from Yuma to the Gulf of California along the general course of the Colorado River is about 75 miles. The distance to the Salton Sea is not very much greater, but the difference in elevation between the gulf and the Salton Sea is about 280 feet. The gradient from Yuma to the gulf is about two feet per mile along the windings of the river, which is the natural gradient adopted by this river under the circumstances with which it is beset. The channel to the Salton Sea, therefore, had more than 200 feet surplus declivity, so that the water in running through that channel was rapidly eroding its bed. It cut the gorge wider and deeper near the Salton Sink and formed great falls or cataracts in the channel. The channels near the vicinity of Calexico had been so nearly obliterated with the lapse of time that



A Section of the Imperial Valley Which Was at First Inundated and Then Left High and Dry by the Deepening Channel

This photograph shows how the Southern Pacific Railroad tracks were cut into and washed out before the river found any channel or before the channel had cut any depth in the ground. Location, 6½ miles southeast of Calexico

This photograph shows the way in which acres and acres of fine farm lands are undermined and washed into the New River channel. It was taken 4½ miles northeast of the town of Brawley, California

the waters spread over a large area of the country, and as the quantity increased threatened to engulf the farms and the town of Calexico. Large dikes were hurriedly built to shut out the water, and the town was thus saved from disastrous inundation before the waters rose high enough to sweep it away. In the meantime channels formed near the Salton Sea, and were cutting deeper and deeper, the cataracts therein were advancing upstream as the water undermined them and carried the debris into the sea. As these cataracts advanced upstream they left below them, of course, deep channels, which carried all the water far below the surface of the surrounding country to the Salton Sea. In the early part of the present year the cataract in New River had reached Calexico, after which, instead of threatening to overflow this town, the water was in a gorge 45 feet below the surrounding country. Opposite Imperial the channel of New River is over 80 feet in depth and that of the Alamo nearly as deep.

The large amount of water flowing down the Alamo River was rapidly eroding this channel throughout its course. Sharp's Heading is a cheap wooden structure and has been for some time in imminent danger of washing out, which would have left the canals of Imperial Valley without water for irrigation, though domestic water might have been obtained with great effort from the deep channels of the Alamo and New rivers.

THE RETREATING CATARACT

The deep channel in the Alamo River, which passed Holtville in August, was gradually approaching Sharp's Heading, and it was recognized that when this cataract reached the heading it would be very difficult and expensive, and perhaps impossible, to maintain that heading. This, however, was not the only peril to the water supply of the valley. The channel of New River had eroded to such an extent that where the two streams separated it was estimated that four-fifths of the water was running down New River and only one-fifth down the Alamo. While this proportion was favorable to the regimen of the Alamo and the safety of Sharp's Heading, it was very threatening in another respect. It accelerated the cutting of the New River channel, in which was a great cataract four or five miles below the separation of the two streams, and this was, of course, advancing upstream. It was well recognized that when this cataract reached the Alamo the channel would be so deep that all of the water would run down New River and leave Sharp's Heading on dry land, without any water for the irrigation of the Imperial Valley. Threatened first with inundation, and next with the destruction of their entire water supply, the inhabitants of the Imperial Valley have naturally been almost in a state of panic for several months.

THE SAFETY OF $100,000,000 IN THE BALANCE

The continuation of the flow of the Colorado River into the Salton Sea meant the gradual inundation of the entire Imperial Valley. Whether the lake would ever rise high enough to actually flow out through Volcano Lake to the Gulf of California is problematical. Volcano Lake is about 30 feet above sea-level. Taking the mean annual discharge of the Colorado River at 9,000,000 acre-feet and the evaporation at 6 feet in depth per annum, the lake would fill in 40 to 50 years and would flow a considerable stream perennially into the Gulf of California. But taking the more probable values of 8,000,000 acre-feet for the mean annual inflow and 7 feet in depth for the mean annual evaporation, the depression would never fill. It would rise to a point 8 or 10 feet above sea-level and oscillate above and below this level in accordance with the fluctuating annual discharge of the Colorado River.

Either result, however, would have been destructive of enormous interests. It would have submerged 150 miles of

the railroad track of the Southern Pacific road, and would have required extensive alterations of its alignment in the vicinity of Yuma. The rapid erosion of the channel leading to the Salton Sea would advance upstream slowly but surely. It has already cut the channel at Yuma two or three feet below the former level. This cutting would be continued until the 200 odd feet of excess fall in the channel had been distributed up the Colorado River, eventually, perhaps, as far as The Needles. It certainly would have cut a deep channel up to Parker—so deep that it would probably have been entirely impracticable to dam and divert the Colorado River at any point below Bill Williams Fork, and thus it would have become impossible to irrigate the great valleys of the Colorado River. These valleys aggregate about 400,000 acres. It is estimated that there are 300,000 acres of fertile irrigable land in the Imperial Valley and twice as much more in the Colorado delta in Mexico. The lands referred to are now settled by a population of 12,000 to 15,000 people, most of whom would have had to abandon their homes.

It may be said, therefore, that during the past year the fate of 700,000 acres of fine irrigable land, in a semi-tropical climate, the homes of over 12,000 people, and 150 miles of railroad track have been trembling in the balance. It is impossible to assign definite values to all these elements, but $100,000,000 would not be an overestimate.

The railroad company spent immense sums of money in repeated removals of its track, as the shores of the Salton Sea grew higher and higher, and also experienced great difficulty in preventing the destruction of its bridge across the Alamo River, as the channel cut deeper and wider. The railroad company appreciated the gravity of the situation in the summer of 1905 and made a large loan to the irrigation company for the purpose of damming the channel. Repeated efforts to do this were unsuccessful, and the control of the irrigation company passed into the hands of representatives of the railroad company. About one year ago the construction of a dam across the new channel was in progress, and strong hopes were entertained by the railroad people of the success of the attempt, when a very large and unexpected flood came down the river, which carried away the works and left the situation more threatening than ever. As soon as the water subsided sufficiently the efforts were renewed and continued throughout the spring of 1906 without success. When high water came in May the company was obliged to abandon its efforts until after the flood season. The heavy discharge of the river during May, June, and July nearly all went down the Alamo and New rivers and cut the channels larger and larger. The railroad south of the Mexican line was entirely washed away, the former site finally becoming a deep channel.

THE DESTRUCTIVE CATARACTS

The cataract in New River advanced upstream past Calexico, took away some of the buildings of that town, and nearly all of the buildings of the Mexican village of Mexicala, and continued to advance eastward at a threatening rate. The Alamo River cut back similarly, and in August, 1906, the cataract had passed the town of Holtville and caused the temporary shutting down of the power plant at that place. In the endeavor to prevent the destruction of valuable buildings and farms, the people made strenuous attempts to guide the cutting of the water by the use of dynamite to assist the cutting where it would do less damage than if left to its own inclinations. It is not apparent, however, that any great benefit resulted from these attempts. During the high-water season of 1906 the irrigation company made two plans for the diversion of the destructive waters. One of these, the success of which was relied upon, was the construction of large headgates at the foot of Pilot Knob, substantially

as originally planned by the engineers. It was planned to dig a channel from the river above these headgates large enough and deep enough to divert the water without very much obstruction and carry it to the Alamo River below its junction with the Colorado. This would leave the new channel dry and permit a dam to be built there and levees along the river to close the disastrous break. This work, however, required a very large amount of excavation, estimated to cost nearly a million dollars. The headgates were built, but no sufficient machinery was available for the excavation, and the construction of a mammoth dredge was undertaken at Yuma. This dredge, mounted upon an enormous pontoon, was to have a capacity of lifting about six tons of material at once, and is now finished and at work.

Realizing the large amount of time that would be required for this excavation, and in the face of the heavy cost of repeatedly moving its tracks onto higher and rockier ground along the Salton Sea, the company concluded to make a preliminary attempt to dam the new channel by constructing a by-pass around the proposed dam site, through which the water could flow as the dam raised it higher and higher. Wooden headgates were built in the by-pass, and in August the construction of the dam was commenced.

DESPERATE ATTEMPTS TO REGAIN CONTROL

At this period the situation looked very gloomy; every condition was unfavorable; the river, instead of coming down to its normal low water, was discharging nearly twice as much water as it ordinarily does at that time of year. The large amount of construction in progress in the Southwest made it extremely difficult to obtain and keep laborers in the hot climate and primitive surroundings of a construction camp. The great heat also made it extremely difficult to employ animals to advantage in excavation or transportation of material. The heavy demands made upon rolling stock made it very difficult and expensive for the railroad company to transport materials for this construction; but, in spite of all these difficulties, the officials, with commendable energy, poured money and men into the breach with an unstinted hand, with the determination to make this effort successful. It was recognized that the work was daily becoming more difficult; the channel was cutting deeper and deeper, and if the river were not controlled during the present low-water season it probably never could be, as another high-water season would cut the channel so deep that, without rock foundation or any means of holding a large structure, it would be impossible, or at least enormously expensive, to accomplish the work the following or any subsequent year.

A railroad was built from the main line to the proposed dam site and continued across the river on piling; a large camp was constructed and laborers assembled; huge pile-drivers and dredges were brought to the ground, and piles were driven at intervals across the channel where it was proposed to build the dam. At points about 500 feet apart in the river and along the located line of the trestle, two bulkheads were built, one composed mostly of rock and brush on the south side, and the other almost entirely of fascines, on the north side. A mat 100 feet long, up and down stream, was placed on the bottom between these abutments, the piles of the trestle pinning the mat to the bottom. Over part of this mat a second mat was placed.

Immediately after the construction of the railway across the river the operation of building the remaining 500 feet of dam between the two abutments was begun. Steam shovels loaded 40-yard automatic dump cars at quarries four miles away, and train-loads of these cars were run out on the trestle and dumped into the river upon the mat. Gradually the river rose, until on October 10 the difference in elevation of the water above and below the dam was six feet, and practically the whole river was flowing through the gates.

The engineers in charge had detected cutting in front of and below the gates, and in anticipation of their failure had built a trestle across the river above the gates, with the intention of dumping in enough rock to partially close the gates and relieve the situation there. At 3.15 on Thursday, October 11, a large part of this gate, known as the Rockwood gate, went out. The river rapidly scoured a deep channel, lowering the surface of the water above the dam until there was only a difference in elevation of about three feet. Work was immediately begun on repairing the trestle below the gates, which had been injured both by the increased flow and by the timber carried away from the gate. From all the available quarries within a radius of from three to four hundred miles, rock was hurried to this point and dumped rapidly from the lower trestle. At the same time the trestle which had been started above the gates was strengthened, and as soon as it was in shape cars were run out on that and rock dumped in. In the meantime part of the material that had been dumped between the two abutments in the river and over which the overflow had taken place was removed and gradually the channel through the Rockwood gate was filled up.

When this was entirely filled, so as to throw the entire flow of the river over the central portion of the dam, the filling of this portion was again resumed. Large blocks of granite weighing several tons, as well as smaller material, was hauled out as rapidly as trains could bring it .and gradually the gap was closed.

The river during all this time did not go below about 9,000 second-feet, adding materially to the difficulties expected.

On November 1 there was an eleven-foot difference in the elevation between the water below and above the dam and about one-half the water in the Colorado was going down its old channel. By noon of November 4 the dam was high enough so that practically the entire flow of the Colorado River was returned to its old channel, and since this time the work has steadily gone on raising the dam and riprapping its upstream and down stream slope.

Great credit is due to Mr Epes Randolph, general manager, and Mr H. T. Corey, engineer in charge, for the energy and skill with which this work was handled.

HOW SOON WILL THE LAKE DRY UP?

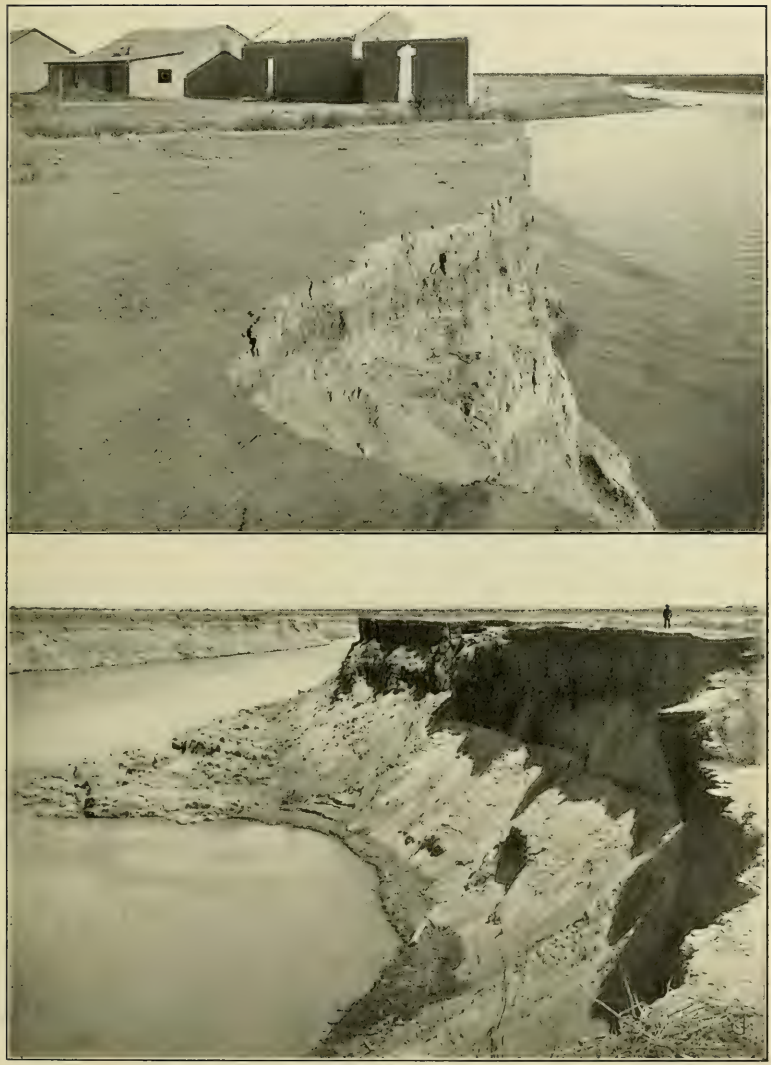
The area of the present Salton Sea is over 400 square miles, and its depth about 90 feet. If the river discharges no water into the sea, it will probably dry up in about 10 or 12 years.

Levees must be built along the entire western bank of the Colorado River from Pilot Knob to high ground far into Mexico, probably 15 to 20 miles, because if high water ever overflows this river again and reaches the deep channel which now exists there, it will rapidly erode the channel back to the river and the disaster of 1905 will be repeated.

In order to prevent the Imperial Valley being deprived of water for irrigation, it is necessary to build a new canal from the headgates at Pilot Knob to the channel of the Alamo River. This can doubtless be completed in a few months, and some water is already flowing through the old Imperial Canal, which is approximately along the same line, so there is no danger to the people of the Imperial Valley.

Some persons have suggested that the existence of the Salton Sea during the past year has had a tremendous effect upon the climate in that vicinity in Arizona, and even as far east as Texas and New Mexico. Much publicity has been given to this idea, it having been caught up by newspapers as something worthy of a story.

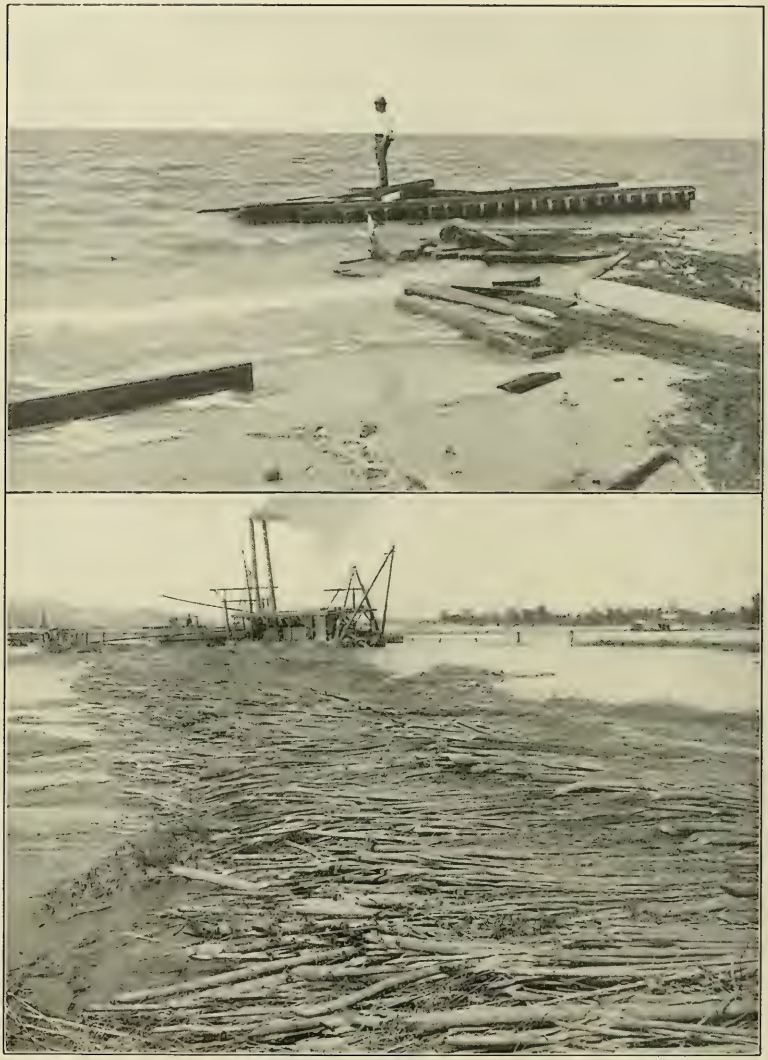
The absurdity of any such idea may be inferred when we notice that only a short distance to the southward of the Salton Sea occurs the great inland Gulf of California, which is hundreds of times larger than the Salton Sea, and yet there is no very marked influence upon the



Cutting Work of the New River

This photograph shows how the Mexican town called Mexicala was partly destroyed by the New River cutting into the town at this point

Cut and washed banks in the big bend of the New River, 5 miles northwest of the town of Imperial, California. These banks are from 60 to 80 feet in height and are constantly caving into the river bed and washing away, consequently widening the river and cutting back onto the farm lands



The Great Salton Sea, 205 Feet Below Sea-level at this Point, Near the Salton Station on the Southern Pacific Railroad

Brush dam at the headworks of the California Development Company's dam in the Colorado River, just below the old river bed

A few months ago this was fertile land cultivated by prosperous people. Looking down New River canyon from a point in big bend, 5 miles northwest of Imperial, California

climate. Besides being so much larger, the Gulf of California is somewhat nearer Arizona, New Mexico, and Texas and is separated from them by fewer mountain chains. If any influence could be exercised by the Salton Sea, hundreds or even thousands of times as much influence would be exercised by the gulf itself; yet no such influence can be detected in that vicinity.

Those who hold to this idea apparently ignore or neglect the fact that the same causes that have led to the creation of the Salton Sea have led to the cutting down of the bed of the Colorado River and the prevention of its normal annual overflow at Yuma and all points below there. The great delta, therefore, which is annually overflowed under normal conditions has received no such overflow since the river has been running into the Salton Sea, at least during the past high-water season, and this fact itself would counteract any influence that might have been exerted by the evaporation from the surface of the Salton Sea.

Climate is the result of great cosmic influences so great and extensive that the Salton Sea would be a negligible quantity beside them.

CONDITIONS WORSE THAN BEFORE

A few days after this address was delivered, the Colorado River worked its way around the dam, which had been built at cost of so much labor and money, and plunged on again to the Salton Sink. The flow of water has been unusually great for this time of year, which complicates the situation. The cataract of the New River has now advanced a long way above Mexicala and is rapidly approaching the Alamo. If the cataract once joins the Alamo the entire Imperial Valley will be cut off from water, and left high and dry until the new Salton Lake has risen sufficiently to inundate the entire region.

Some perplexing questions as to who is responsible for the damages will arise, for the company whose carelessness caused the break is chartered under the laws of Mexico, while all the capital and all the stockholders are American. The break, furthermore, occurred in Mexican territory.

The Southern Pacific Railway is making herculanean efforts to turn back the river, but the situation has become very desperate.

The Hubbard Medal of the National Geographic Society, the First Award of Which was Made to Commander Peary December 15, 1906

Not only the people in the Imperial Valley are threatened, but also the Laguna Dam above Yuma, which has been built at a cost of one million dollars. The great cataract, which resembles Niagara Falls and is 1,500 to 1,800 yards wide and has a fall of 90 to 100 feet, is working backward at the rate of one-third of a mile a day. If not checked it will reach and destroy the Laguna Dam, and ultimately deprive of water every farm along the Colorado River up to the Grand Canyon, causing a damage of approximately one billion dollars.

HONORS TO PEARY

An account of the presentation of the Hubbard Medal to Commander Robert E. Peary, U. S. Navy, by President Roosevelt, on behalf of the National Geographic Society, at the annual dinner of the Society, December 15, 1906, with the congratulatory addresses of President Roosevelt, the Italian Ambassador, and the Secretary of the Navy, and Mr Peary's responses.

ABOUT 400 members and guests of the National Geographic Society united to pay honor to Commander Robert E. Peary, U. S. Navy, on the occasion of the annual banquet of the Society, December 15, 1906. Ten nations were represented by members of the diplomatic corps and 20 states by Senators and Representatives. A number of members came from New York and Philadelphia to attend. The feature of the evening was the presentation of the Hubbard Medal to Mr Peary by President Roosevelt on behalf of the Society. The medal was specially struck for the occasion, being made by Tiffany & Co., of New York, under the direction of Mr George F. Kunz, a member of the Society. On one side it bears the seal of the Society, and on the reverse the following inscription: "The Hubbard Medal, awarded by the National Geographic Society to Robert E. Peary for arctic exploration. Farthest north, 87° 6′. December 15, 1906." A blue sapphire star, from Montana, marks the point of farthest north attained by Mr Peary.

The members were received in the parlors of the New Willard by the President of the National Geographic Society and Mrs Moore, Commander Peary (illness prevented Mrs Peary from being present), and the Secretary of the Navy, from 7 to 7.30, after which the company adjourned to the banquet hall. After an invocation by Dr Edward Everett Hale, Chaplain of the U. S. Senate, the guests took the places assigned to them at the twelve long tables, which had been decorated by Small & Sons. The U. S. Marine Band played throughout the dinner. President Roosevelt arrived after the dinner had been served and while Dr Cook was speaking.

The first toast of the evening was drunk to the President of the United States, and while the guests were standing the toastmaster, President Moore, asked all to join in a moment of silent memorial to the first President of the Society, Gardiner Greene Hubbard.

In his introductory remarks President Moore called attention to the fact that the National Geographic Society numbered in its ranks the best men of the best nations of the world. He declared that there were present at the dinner some of the men who had achieved the greatest discoveries in science, the greatest lawmakers, the highest representatives of the church. He said that from small beginnings the Society had grown until it now numbered 18,000 members, and he added: "We are not modest in our ambitions; we wish to know all about the earth, and the waters under the

earth, and the heavens above the earth." Briefly, he recapitulated some of the triumphs achieved by members of the Society, explorations in the South Pacific, in darkest Africa, and the farthest north. He recalled that in the year 1882 the farthermost point in the arctic regions was reached by an officer and founder of the National Geographic Society—General A. W. Greely, who held the much-coveted prize for fourteen years, when it was wrested from him by that hardy Norseman, Nansen. He in turn was eclipsed by the Duke of Abruzzi, and it had remained for Commander Peary, of America, to rob Italy of her well-won honors. As the representative of the Duke of Abruzzi's country was present, he would ask him to respond to the toast: "Congratulations from Italy on America's farthest north."

BY THE ITALIAN AMBASSADOR, BARON MAYOR DE PLANCHES

Mr President, Ladies and Gentlemen:

I beg to express, before all, my best thanks to the National Geographic Society for the kind invitation I received from it to attend this solemn assembly.

Solemn, not only in the etymological acceptance of the word—*sole in anno*—but in its largest extent, because you are here gathered not only for your annual banquet, but to celebrate a great deed and a great man.

An Italian, a son of our ancient and illustrious royal family, a prince who is at the same time a true seaman, held for several years the record of the farthest latitude in the arctic regions. This record is now yours, Commander Peary. With what energy, with what almost superhuman endurance, you obtained it, is world-wide known, and I am sure that the Duke of Abruzzi, so high-minded as he is, applauds the triumph of his glorious emulator. Nobody was more worthy of success than you, Commander Peary—you, an American, you a veteran, a young veteran, indeed, of the war against the mysterious powers that jealously defend the approach of the Pole.

In the fields of science, there is no place for low feelings; in the competition for the conquest of the globe, there is no sentiment of envy. All work for humanity. I am therefore happy to tribute, on behalf of the Italians, to you, Commander Peary, to your courageous and faithful followers, to your intrepid companion, Mrs Diebitsch Peary, the most sincere expression of our deep, warm, and heartfelt admiration.

COMMANDER PEARY'S ACKNOWLEDGMENT TO THE ITALIAN AMBASSADOR

Mr Ambassador, I deeply value your kindly words. Coming from the illustrious representative of the country which claims Abruzzi and Cagni, they are doubly prized. The fact that such names as Abruzzi, Cagni, Nansen, Greely, and Parry are indelibly inscribed upon the white disk close to the Pole, shows conclusively, if anything were needed to show it, that these efforts to solve the northern mystery represent the biggest, cleanest, most manly example of friendly international rivalry that exists.

It is a magnificent galaxy of flags that has been planted around the Pole, and when eventually some one of them shall reach the Pole itself, it will add to its own luster without in any way detracting from the luster of the others or leaving any sense of injury or humiliation in its wake.

The fact that years of experience have enabled me to plant the Stars and Stripes nearer the Pole than the colors of Italy in no way lessens D'Abruzzi's honors or his magnificent feat. It causes no surprise on our part when Norsemen, Britons, and Yankees seek the rigors of the north; but when a son of the south, of sunny Italy, strikes swiftest and deepest into the mystery of the frozen north, we recognize that it is the hand, heart, and head that do things in this world, regardless of race, or climate, or other conditions.

Abruzzi has always had my warmest admiration, not only for his own personal attributes and the fact that what

he sets his hand to do he does, whether it be in the frozen north, or in the heart of Africa, but because he presents, as I remarked on the occasion of the award to him of the great gold medal of the American Geographical Society in New York, such a shining example to the gilded youth of unbounded means in this and other countries who have no higher ambition than to possess the fastest automobile or to win the blue ribbon at some fleeting horse or dog show, when they might, like Abruzzi, devote their time, their abilities, and their money to adding to the sum of human knowledge.

One thing have I envied him, and that is the power that when he sees something in the world of exploration which he feels ought to be done he can put his hands in his pocket and go and do it, without wasting the greater portion of his gray matter in raising the sinews of war, and thus being compelled to enter upon the work almost exhausted in mind and body. I trust he may long continue to win new honors for his country, and should he or any other in the near future better the record or reach the Pole itself, our hands shall be extended in warmest congratulation to one whom we shall know is a man.

ANNOUNCEMENT BY PRESIDENT MOORE OF THE ELECTION OF GEORGE DEWEY, ROALD AMUNDSEN, AND MORRIS K. JESUP AS HONORARY MEMBERS

The National Geographic Society has for honorary members President Roosevelt, Nansen, the Duke of Abruzzi, Grover Cleveland, Robert E. Peary, and Prince Roland Bonaparte, the latter dividing the honor of relationship with one of the distinguished members of the Cabinet of the United States. The Board of Managers of the National Geographic Society has recently elected as honorary members Admiral George Dewey, who has had something to do with the geography of the world; Roald Amundsen, who has recently completed the Northwest Passage, and Morris K. Jesup, President of the Peary Arctic Club.

From Mr Morris K. Jesup, the President of the Peary Arctic Club who has largely borne the expense, with some few of his friends of the Arctic Club, of sending this magnificent expedition, commanded by our august explorer, Commander Peary, we have just received the following telegram:

"To the National Geographic Society, Washington, D. C.:

"Very much regret being unable to be present this evening at your banquet for Peary. He is worthy and entitled to all the honor that his country can bestow.

"MORRIS K. JESUP."

The next toast is the "United States Navy." What man is there whose breast does not swell with pride when he thinks of the achievements of the United States Navy—from the flag that Paul Jones first unfurled to the fighting breezes until we come down to our own contemporary men, Dewey, Sampson, and our own beloved Schley! The navy has had much to do besides the manning of ships of war. It has explored the ocean depths, it has marked the boundary lines of islands, and it has sent great expeditions into the north. So our navy has done much that we can be proud of, and it is highly appropriate that a toast should be given tonight to the United States Navy; and who is more worthy to respond to that toast, and who better illustrates in his own light and his own achievements the best that there is in American citizenship than Charles J. Bonaparte.

THE UNITED STATES NAVY, BY HON. CHARLES J. BONAPARTE

Mr President, Ladies and Gentlemen:

Before speaking of the toast to which I am asked to respond, I wish to express our gratitude to our friend and special guest this evening, not merely for not having found, but having come pretty near finding the Pole, but also for having solved in his speech this evening one of those problems which at present are perplexing the souls of the more thoughtful among the American people. We want to know what we shall do with our

multi-millionaires. I was in a great deal of doubt on that subject myself until I heard the speech to which we last listened. Now the solution has been cleared. We may send the young ones to the North Pole and the old ones can pay for getting there.

Now, ladies and gentlemen, I have been asked to respond to the toast "The American Navy." I hope that many of you will often attend many of the banquets of the National Geographic Society. It will be my very undeserved good fortune if I am so happy as to be with you at more than one of them, but surely this is the only chance that I will ever have to answer to this toast, for the navy is about to get rid of the least worthy element in it; and it is only by taking advantage of the few hours of very undeserved honor that remains to me that I am qualified for answering, as I am about to answer this evening.*

The navy in rendering the service it has always rendered to our country has aided in many things. Solving these mysteries of the northern wilderness to which our attention has already been called, however important in itself, is after all only a part of the duty which the navy has to render, and only a part of the claim which it has on the gratitude and admiration of its countrymen; for I may say with a good grace, since no one will think that I am entitled to any of the credit which I claim for it, that it has always been ready under all circumstances and at all times to do its duty; and what more can any one claim?

I am about to leave the navy, and I therefore feel that I may take advantage of your ill-judged kindness in calling upon me to deliver a sort of funeral oration of the involuntary suicide which I am about to make. I will endeavor to praise only what is worthy of praise, and to call your attention not to the unimportant matter of who signs the navy's mail, but to the really important matter of whether this country, of which you are the worthy representatives, gives to that branch of its public service the support in sympathy, in appreciation, and money which it deserves from any country which has sense enough to know when it has a good thing and ought to keep it.

It is difficult for a Secretary of the Navy who has not outgrown all desire to have his country show itself worthy of the good fortune that a kind Providence has given it—it is difficult for such a Secretary to avoid feeling some unphilosophic indignation at the want of appreciation of the immense value of this great factor of our nation's honor and safety and the peace of the world which I see every day in the exponents of public opinion around us. I, however, do not propose, in the funeral oration to which I have already referred, to dwell on the shortcomings of the world in general and America in particular, in its failure to fully appreciate the merits and sacrifice of its seamen, but I wish to ask of you all to use the legitimate influence which each one of you has, and which all of you have so much in this community, to enable your fellow-citizens to understand, as I feel sure you understand, how important it is to the dignity, the usefulness to mankind, and the self-respect of the American people that it should treat its navy as that navy deserves to be treated and as the interests of the country demand.

In the first place, let us all understand that by having this safeguard of our peace and independence and needed national existence we are spared enormous burdens borne by less favored nations, and of which we cannot even appreciate the weight, so little have we reason to fear. In the next place, let us understand that these men, who are ready to serve us in all contingencies, and amid all dangers, and at the cost of all sacrifice, deserve to be regarded by their fellow-countrymen as worthy at least of gratitude and respect.

I saw the other day in one of our newspapers a comment, and I may say criti-

* The speaker became Attorney General of the United States December 17, 1906.

cism, on my annual report, in that I showed too much warmth at the discrimination, the insulting discrimination, shown in certain parts of this country against the uniform of our sailors. Now, ladies and gentlemen, let me detain you two or three minutes by enabling you, as intelligent and public-spirited men and women, to understand what is meant by the discussion on that subject, for if you understand it, that is all that any one can ask. Our ships are manned in great majority by young men from the farms and homes of our country, men between eighteen and twenty-five years—boys, most of us would be disposed to call them—who are not the old nomadic cosmopolitan sailors of former days, but are men who respect themselves, and who desire the respect of others, and who look forward—I do not deny that there are black sheep in every lot, and some in these—to becoming useful and respected members of society. These boys are away, isolated from all amusements, leading a monotonous life on ships for months at a time, and when they return to port and are given the opportunity to do what every young thing wants to do, kick up its heels, and have the inclination which it is perfectly natural and perfectly laudable of men of their age and surroundings to have, to be rewarded for this long period of monotonous isolation by a certain amount of amusement and distraction—these men have, in too many parts of our country, all reputable sources of amusement and relaxation closed to them for no other reason than that they are clothed in the garments which show that they are serving their country. And what are the consequences? That, excluded from the places where they might be amused innocently and creditably, they are driven into haunts of vice, with the consequences that would naturally follow. It is not a trifling matter; it is a matter of which any community which endures it has every reason to be ashamed; and when the Secretary of the Navy, in company with the President of the United States and with all prominent officers of the service, feels and expresses indignation at such treatment for such men, for such service, I say that is no ground for observation that he grows hot over trifles.

Again, I ask of you to use your influence, the influence which each one of you has, in such circles as he or she frequents, to make the people of the United States understand how grave a thing it is to hamper the development of this branch of the national defense, when you must know that in its keeping is the safety of our country from perils too serious to be lightly mentioned, and yet which are often inexcusably forgotten.

THE TOASTMASTER

Watts gave to us the steam-engine, Fulton the steamboat, Morse the telegraph, and finally Bell the telephone. Probably no man has done more to link humanity together, to make us all one kin, than he who has solved the great problem of sending the beautiful modulations of the human voice over a metallic circuit. Our Society was honored by having that man for its President, and if I could express and enforce my own opinion and that of the members of the National Geographic Society, he would still be the President of the National Geographic Society. We love him, and I am going to introduce him now to say a few words and to have him introduce Dr Cook, not because we need him to wake things up, but I want you to see him, Alexander Graham Bell.

REMARKS BY DR ALEXANDER GRAHAM BELL

Mr President, Ladies and Gentlemen:

I am indeed proud of this gathering of the members of the National Geographic Society, and to think that I once had the honor of being your President. I remember well when the mantle of your first President, Mr Hubbard, fell on my shoulders, and we looked at this little seed that he helped plant. Could we ever suppose it could grow into the great national organization that we have today? That little seed! And yet I can still re-

member when we congratulated ourselves upon a thousand members; but today we number eighteen thousand members; this little seed has grown into a tree and covers the whole world; wherever Americans are, there we find members of the National Geographic Society.

But I have been asked to say a few words about a man who must be known by name, at least, to all of us, Dr Frederick A. Cook, President of the Explorers' Club, New York. We have had with us, and are glad to welcome, Commander Peary, of the Arctic regions, but in Dr Cook we have one of the few Americans, if not the only American, who has explored both extremes of the world, the Arctic and the Antarctic regions. And now he has been to the top of the American continent, and therefore to the top of the world, and tonight I hope Dr Frederick Cook will tell us something about Mount McKinley.

THE TOP OF NORTH AMERICA, BY DR F. A. COOK

Mr Chairman, Ladies and Gentlemen:

I would prefer to tell you tonight of the splendid achievement of Commander Peary and of the noble character of the man who has succeeded in pushing human endeavor to the utmost limit of endurance, all with the unselfish motive of carrying the honor and the flag of his country to the farthest north but your chairman has put me to the task of getting to the top of our continent.

In the conquest of Mount McKinley success was mostly due to our use of the working equipment of polar explorers, and among polar explorers Commander Peary has worked hardest to reduce the outfit to its utmost simplicity. Thus indirectly to Commander Peary should fall a part of the honor of scaling the arctic slopes of our greatest mountain.

Mount McKinley is in mid-Alaska. It is 20,300 feet high. Its summit pierces the frigid blue one thousand feet above any other mountain on the North American continent. It is, then, the top of our continent and the most arctic of the big mountains of the world. The country to the east was entirely unknown, and the country to the west but roughly outlined. A venture to ascend this mountain must therefore assume the responsibilities of an exploring enterprise and be prepared for all kind of difficulties.

Three years ago, as Commander Peary was preparing for his assault upon the North Pole, I organized an expedition to ascend Mount McKinley from the west. In this we failed, but we carried a line of exploration through and around the range.

Last spring I organized another expedition upon a similar general plan. My chief companions were Prof. H. C. Parker, Russell W. Porter, Belmore H. Browne, and Edward Barrille. We took twenty pack horses from Seattle for our difficult cross-country transportation, and for the river we built a powerful motor boat.

We reached Cook Inlet early in June. During June and July we forded and swam icy streams, pushed through thick underbrush, and over gloomy marshes, only to find that the part of the mountain which we finally reached was impossible for an ascent.

A good deal of pioneer work was done at this time, but the opportunity to make an attempt to climb did not present itself until early in September, after all hope of mountaineering had been abandoned. The launch was pushed up the Susetna and the Chulitna rivers to the east of Mount McKinley. From here with two men I aimed to explore a route for a future ascent.

We left the boat and with our camp equipment and instruments in rush sacks we started for the mountain. In an air line we were forty miles from the summit, and from our position we noted three possible lines of ascent. A large glacier which we had previously discovered offered us here a highway through the giant foothills. In three days we were against the main slope of the great mountain; but here our difficulties began.

I was fortunate enough to have two

loyal supporters, Barrille and Dokkin. Barrille was chosen as my sole companion for the upper work, while Dokkin was instructed to place a line of caches along the glacier. It was now September 11, winter was advancing rapidly; snow covered all the foothills down to 2,000 feet, and frosty storms must be expected. We had explored the first glacier, which was our main mission at this time, but the route to the summit was as uncertain and seemingly impossible as ever, but on the morrow we resolved to make a vigorous trial.

Our silk tent was pitched on the glacial ice. We ate pemmican, drank tea, and put down hard bread while a strong wind was rushing down from the gulches of the big mountain. Huge black clouds were so low that we could almost touch them, and through them rushed soul-stirring avalanches; great boulders of rock and ice, followed by a hiss, a gust of wind, tons of snow, explosive noises, and the entire range quivered as from an earthquake. The noise of the cracking glaciers increased with the advancing night, but the avalanches decreased, the clouds brightened, and at dawn the giant slopes of Mount McKinley loomed up in the blue twilight, sharp, steep, pointing heavenward so far up—so inconceivably high that it took our breath as we tried to estimate the task of climbing. I never felt so small and the sky never seemed so distant. We were shivering as we melted ice for tea and ate pemmican, but as the sun burst over the icy spires, and a million reflecting surfaces threw piercing rays from slope to slope we warmed up to our enterprise.

The bright blaze of this sunburst remained with us long enough to get started into a maze of blue crags and gloomy granite cliffs. We were aiming to get to the north arête for our day's task. Cloud after cloud drifted on us, and each cloud was preceded and followed by a brief blast of icy wind. Hour after hour we dug our feet and hands into the snow in desperate effort to get from crevass to crevass, from grottos to cliffs, always gaining a little altitude and rising farther and farther into cloudland, with its awful cold and stormy agitation. The day was a long one. Without food or drink, with little rest or relief from awe-inspiring excitement, we ascended until about 7 p. m. Here, on a cornice, we built a snow house and within we found rest and comfort, amid cloud and storms.

The day after the sun again broke through the clouds of snow for a few brief moments. We noted the bright, snowy slopes of Mount McKinley with less fear and more courage. We were at 12,000 feet, and but one difficult cliff barred the way to the summit, and we resolved at all hazards to find a way around this barrier. The way proved, however, a long one. For two days we chopped steps, dragged each other over dangerous ice cornices and slippery rocks, and as we had conquered this impediment we rose out of the cloud world of storm into a region of silence and serenity. Above were the easy slopes of the top; below, a chaos of cliff and spire, a maze of crags and grottos, with clouds wildly sweeping the slopes.

We had now risen to nearly 15,000 feet before we could assure ourselves that an ascent along our chosen route was possible. We were chilled to the marrow and our forces were about exhausted. Would we push on to the summit or return? We agreed to push to the summit. It was our sixth day on the climb, and we estimated that another long day would place us on the summit. But now our legs were heavy, our packs like lead; we were heaving for breath, with icicles forming on our mustaches and hearts thumping like a gas engine in trouble. Two thousand feet was all we could put to our credit on the seventh day; but, starting early in the morning of the 16th of September, we began the last weary climb. It was hard to lift one foot above another; but the slope was easy, and with much forced effort we made a few hundred paces, leaned over our ice axes, puffed a few minutes, and then went

farther. We dropped on a snow slope a few hundred feet below the summit and tried to rest, while we gasped for breath; but the piercing air chilled us; and so, with knees bent, and back bent, and chests laboring like bellows, we digged one foot after another over the big blocks of granite at the top. The summit at last—the top of the continent. Our North Pole had been reached. To an ice axe the flag was attached, and Barrille stood on the brink, as near heaven as he ever expects to get and live. We had been eight days in ascending, but we remained only twenty minutes. It would, however, take me several hours to tell you what we saw. This I will reserve for a future occasion.

THE TOASTMASTER

The National Geographic Society is honored by the presence of the Chief Executive of the United States.

The Board of Managers of the National Geographic Society, representing, as was said earlier in the evening, eighteen thousand members, widely scattered over the civilized world, have by unanimous vote ordered that a handsome gold medal be presented to Commander Robert E. Peary for distinguished service in exploration, and for having reached the farthest north, 87 degrees and 6 minutes. Because of the many distinguished achievements that stand to his own personal credit, to add honor to that medal, we are proud of having it presented by the President of the United States with his own hands.

ADDRESS BY PRESIDENT ROOSEVELT

Mr Chairman, Ladies and Gentlemen:

I count myself fortunate in having been asked to be present this evening at such a gathering and on behalf of such a society, to pay a tribute of honor to an American who emphatically deserves well of the commonwealth. (Applause.) Civilized people usually live under conditions of life so easy that there is a certain tendency to atrophy of the hardier virtues. And it is a relief to pay signal honor to a man who by his achievements makes it evident that in some of the race, at least, there has been no loss of hardier virtues.

I said some loss of the hardier virtues. We will do well to recollect that the very word virtue, in itself, originally signifies courage and hardihood. When the Roman spoke of virtue he meant that sum of qualities that we characterize as manliness.

I emphatically believe in peace and all the kindred virtues. (Applause.) But I think that they are only worth having if they come as a consequence of possessing the combined virtues of courage and hardihood. So I feel that in an age which naturally and properly excels, as it should excel, in the milder and softer qualities, there is need that we should not forget that in the last analysis the safe basis of a successful national character must rest upon the great fighting virtues, and those great fighting virtues can be shown quite as well in peace as in war.

They can be shown in the work of the philanthropist, in the work of the scientist, and, most emphatically of all, in the work of the explorer, who faces and overcomes perils and hardships which the average soldier never in his life knows. In war, after all, it is only the man at the very head who is ever lonely. All the others, from the subordinate generals down through the privates, are cheered and sustained by the sense of companionship and by the sense of divided responsibility.

You (turning to Commander Peary), the man whom we join to honor tonight—you, who for months in and months out, year in and year out, had to face perils and overcome the greatest risks and difficulties, with resting on your shoulders the undivided responsibility which meant life or death to you and your followers—you had to show in addition what the modern commander with his great responsibility does not have to show—you had to show all the moral qualities in war, together with other qualities. You did a great deed, a

deed that counted for all mankind, a deed which reacted credit upon you and upon your country, and on behalf of those present, and speaking also for the millions of your countrymen, I take pleasure in handing you this Hubbard Medal, and in welcoming you home from the great feat which you have performed, Commander Peary. (Prolonged applause.)

RESPONSE TO THE PRESIDENT BY COMMANDER PEARY

President Roosevelt:

In behalf of the Peary Arctic Club and its president, Morris K. Jesup, I beg to express our deep appreciation of the great honor conferred by the National Geographical Society in this award of its gold medal, and the double honor of receiving this medal from the hand of President Roosevelt.

Your continued interest, Mr President, and permission to name the club's ship after you, has been most deeply valued by the club, and your name has proved a powerful talisman. Could I have foreseen this occasion it would have lightened many dark hours; but I will frankly say that it would not, for it could not, have increased my efforts.

The true explorer does his work not for any hope of rewards or honor, but because the thing he has set himself to do is a part of his very being, and must be accomplished for the sake of accomplishment, and he counts lightly hardships, risks, obstacles, if only they do not bar him from his goal.

To me the final and complete solution of the Polar mystery which has engaged the best thought and interest of the best men of the most vigorous and enlightened nations of the world for more than three centuries, and today quickens the pulse of every man or woman whose veins hold red blood, is the thing which should be done for the honor and credit of this country, the thing which it is intended that I should do, and the thing that I must do.

Assertions that the Pole cannot be reached; that the result of the last expedition is to show the unavaliability of dogs and sledges and of the route followed; that there are better methods for attaining the Pole than by dogs and sledges; that the discovery of the Pole is not a matter of any value or interest, are equally erroneous.

The result of the last expedition of the Peary Arctic Club has been to simplify the attainment of the Pole fifty per cent, and to accentuate the fact that man and Eskimo dog are the only two mechanisms capable of meeting all the varying contingencies of Arctic work, and that the American route to the Pole and the methods and equipment which have been brought to a high state of perfection are the best for attaining that object.

Had the past winter been a normal season in the arctic region and not, as it was, a particularly open one throughout the Northern Hemisphere, I should have won the prize. And even if I had known before leaving the land what actual conditions were to the northward, as I know now, I could have so modified my route and my disposition of sledges that I could have reached the Pole in spite of the open season.

Another expedition following in my steps and profiting by my experience can not only attain the Pole; it can secure the remaining principal desiderata in the arctic regions, namely, a line of deep-sea soundings through the central Polar Ocean, and the delineation of the unknown gap in the northeast coast line of Greenland from Cape Morris Jesup to Cape Bismarck. And this work can be done in a single season.

As regards the belief expressed by some, that the attainment of the North Pole possesses no value or interest, let me say that should an American first of all men place the Stars and Stripes at that coveted spot, there is not an American citizen at home or abroad, and there are millions of us, but what would feel a little better and a little prouder of being an American; and just that added increment of pride and patriotism to mil-

lions would of itself be ten times the value of all the cost of attaining the Pole.

President Roosevelt, for nearly four centuries the world dreamed of the union of the Atlantic and the Pacific. You have planted the Stars and Stripes at Panama and insured the realization of that dream. For over three centuries the world has dreamed of solving the mystery of the north.

Tonight the Stars and Stripes stand nearest to that mystery, pointing and beckoning. God willing, I hope that your administration may yet see those Stars and Stripes planted at the Pole itself. For between these two great logical cosmic boundaries, Panama to the south and the North Pole to the north, lies the heritage and the future of that giant whose destinies you guide today, the United States of America.

The committee of arrangements for the dinner consisted of

Gilbert H. Grosvenor, Chairman; O. P. Austin, Alexander Graham Bell, Charles J. Bell, W. J. Boardman, Colby M. Chester, F. V. Coville, William Crozier, Henry F. Blount, William E. Curtis, George Dewey, John Joy Edson, David Fairchild, Melville W. Fuller, Henry Gannett, J. Howard Gore, John W. Foster, Edward Everett Hale, A. J. Henry, Arnold Hague, John B. Henderson, Jr., Rudolph Kauffmann, Martin A. Knapp, C. Hart Merriam, Willis L. Moore, Simon Newcomb, Theodore W. Noyes, Gifford Pinchot, Marvin F. Scaife, Miss Eliza R. Scidmore, O. H. Tittmann, John M. Wilson.

MEMBERS AND GUESTS PRESENT

Commander Robert E. Peary, U. S. Navy
The Secretary of the Navy, Hon. Charles J. Bonaparte
The Italian Ambassador
The President of the National Geographic Society and Mrs Willis L. Moore
The Japanese Ambassador
The Secretary of Agriculture
The Minister of Bolivia and Madame Calderon
The Minister of Switzerland
Representative and Mrs Kittredge Haskins, of Vermont
Dr Frederick A. Cook
Mr Emory R. Johnson, President Geographical Society of Philadelphia, and Mrs Johnson
Mrs Hobson
Commander and Mrs Key
The counselor of the Japanese Embassy and Madame Miyaoka
The Minister of Colombia and Madame Cortes
The Minister of Norway and Madame Hauge
The Minister of Ecuador and Madame Carbo
The Chargé d'Affaires of Spain
Mr Frederick Courtland Penfield, formerly Minister to Egypt
Mrs George Kennan
Mr and Mrs Tilden
Dr Theodore LeBoutillier, Secretary of Geographical Society of Philadelphia
Dr Anita Newcomb McGee
Judge Martin A. Knapp, President Interstate Commerce Commission
Judge Clark, of the Interstate Commerce Commission
Representative Grosvenor, of Ohio, and Mrs Grosvenor
General George M. Sternberg
Mr and Mrs Herbert Wadsworth
Mr and Mrs Hennen Jennings
The Bishop of Washington
Mrs James W. Pinchot
Senator Hopkins, of Illinois, and Mrs Hopkins
Mr and Mrs Shainwald, of New York city
Representative Dalzell, of Pennsylvania, and Mrs Dalzell
Monsignor O'Connell, President of Catholic University of America
Mr and Mrs Theodore W. Noyes
Mr. Archibald Hopkins
Senator Warren, of Wyoming
Dr and Mrs Alexander Graham Bell
Mr Edward Everett Hale
Prof. Simon Newcomb
Admiral Bradford
Mr Nicholas Luquer
Mr W. C. Whitemore
Mr James Lowndes
Mr W. R. Tuckerman
Mr Nathaniel Wilson
Mr Byron Andrews
Mr W. A. DeCaindry
Gen. John O'Connell
Representative Lamar, of Florida, and Mrs Lamar
Representative Scott, of Kansas
Admiral Winfield Scott Schley and Mrs Schley
Mr W. J. Boardman
Mr John A. Kasson
Dr Z. T. Sowers
Commissioner H. L. West
Miss Hale
Judge Thomas H. Anderson and Mrs Anderson

Rev. J. A. Aspinwall
Dr and Mrs Teunis S. Hamlin
Mr Hillary A. Herbert, ex-Secretary of Navy
Judge Ambler
Representative Richard Bartholdt, of Missouri
Mr Daniel C. Gilman, formerly President Carnegie Institution, and Mrs Gilman
Mr Hanihara, Second Secretary of Japanese Embassy
Mr Crosby S. Noyes
Mr William B. Howland
Mr B. H. Warner
Mr Robert P. Porter
Judge Job Barnard and Mrs Barnard
Mr Herbert L. Bridgman, Secretary Peary Arctic Club
Mr Jesse E. Wilson, Assistant Secretary of Interior
Mr and Mrs C. H. Ackert
Surgeon General Wyman, of the Marine Hospital Service
Dr W. A. White, Superintendent Government Hospital for the Insane
Senator Clarence D. Clark, of Wyoming, and Mrs Clark
Representative Lacey, of Iowa
Hon. George Shiras, Third
Lieutenant General Nelson A. Miles, U. S. Army
Mrs Joseph Kuhn
Senator Perkins, of California
Mr Gardner F. Williams
Dr George M. Kober
Mr A. Maurice Low
Mr Henry C. Perkins
Representative Mann, of Illinois, and Mrs Mann
Hon. Charles D. Walcott, Director U. S. Geological Survey, and Mrs. Walcott
Mr and Mrs E. G. Walker
Miss Laura Bell, of Philadelphia
Mr and Mrs Anthony Fiala
Miss Emily Bell
Mr Charles L. Marlatt
Mr and Mrs Stuyvesant Pillot, of New York
Representative Burton, of Ohio
Mrs Sweat
Mr and Mrs Henry S. Kerr, of New York
Miss Eliza R. Scidmore
Dr and Mrs Hamilton Wright
Mr and Mrs Arthur Dunn
Mr W. R. Hunn, of Philadelphia
Mr George Wood, of Philadelphia
Mr Gilbert H. Grosvenor, editor of the NATIONAL GEOGRAPHIC MAGAZINE, and Mrs Grosvenor
Mr and Mrs Charles Denby
Dr and Mrs George F. Becker
Mr W. S. Irwin, managing editor *McClure's Magazine*
Miss Perkins
Representative Perkins, of California
Mrs Hatton
Mr Gifford Pinchot, Forester of U. S. Forest Service
Mr Hector Fuller
Mr George L. Raymond
Miss Aileen Bell
Dr J. H. Bryan
Miss Bryan
Mr and Mrs D. C. Phillips
Mr and Mrs F. D. McKenney
Mr W. A. Mearns
Dr J. C. Simpson
Mr F. A. Richardson
Mr Frank Sutton
Senator McCreary, of Kentucky
Mrs Wynne
Colonel Casey, U. S. Army, and Mrs Casey
Mr and Mrs Marvin F. Scaife
Prof. Joseph A. Holmes
Mr and Mrs C. A. Richardson
Mr and Mrs A. B. Browne
Mr and Mrs Hutchinson
Hon. Charles Henry Butler
Mr and Mrs Alpheus H. Snow
Hon. O. H. Tittmann, Superintendent U. S. Coast and Geodetic Survey
Mr and Mrs Edgar C. Snyder
Mr Gilson Gardner
Mr Piller
Mr Thompson
Mr John Holmes Magruder
General Shallenberger
Mr and Mrs George H. Judd
Dr and Mrs L. A. Bauer
Dr and Mrs Charles G. Stone
Senator Heyburn, of Idaho, and Mrs Heyburn
Mr James S. Henry
Mr A. F. Emery
Mr Odell L. Whipple
Mr Arthur G. Plant
Mr Frank B. Lord
Mr W. M. Mitchell
Mr and Mrs Futton
Rev. Thomas D. Clark
Miss McCerey
Miss Gena Russell Harding
Rev. and Mrs Ernest Smith
Representative Graff, of Illinois, and Mrs Graff
Rear Admiral Colby M. Chester, U. S. Navy
Mr and Mrs George W. Rouzer
Mr A. A. Adee, Second Assistant Secretary of State
Mr R. L. Fearn
Major and Mrs Reynolds Landis
Mr Wm. B. Thompson
Mrs McCourtney
Dr Muncaster
Mr and Mrs Howard S. Nyman
Mr and Mrs Christian Heurich
Representative Cox, of Tennessee
Senator Burkett, of Nebraska, and Mrs Burkett
Mr A. J. Stofer
Mr Louis Garthe

Dr Ralph Jenkins
Mr John Philip Sousa
Mr E. W. Foster
Mr and Mrs W. H. Baldwin
Mr H. C. Gauss
Dr and Mrs David T. Day
Representative Ransdell, of Louisiana
Prof. and Mrs J. Howard Gore
Mrs M. B. Tulloch
Mr Henry V. Tulloch
Mr Arthur C. Johnson
Mr J. A. Breckons
Mrs W. A. H. Church
Mr Edward S. Jones
Mr Melville Church
Mr W. W. Andrews
Mr Ernest H. Merrick
Mr A. E. Bowers
Mr George Xavier McLanahan
Representative Burleson, of Texas, and Mrs Burleson
Mr and Mrs David Fairchild
Mr John Ross Martin
Mr Frederick E. Mann
Mr Ernest Janson
Mr and Mrs Joseph Crawford
Miss Rollins
Dr and Mrs S. F. Emmons
Miss Pruyn
Dr and Mrs Alberton S. Cushman
Representative Lamb, of Virginia
Mr Gardiner Bell
Miss Pillot
Rev. David H. Buel
Mr Charles J. Bell, President American Security and Trust Co., and Mrs Bell
Mr W. W. Jermyn
Mr B. F. Johnson
Mr and Mrs W. H. Seaman
Miss C. C. Barnam
Miss Hartwell
Rev. S. H. Greene
Mr Bourne
Mr and Mrs Kern
Miss Kern
Dr F. E. Hoskins
Mr and Mrs William E. Curtis
Mr and Mrs Goehring
Mr Milo A. Shand
Mr. Arnold
Mr and Mrs H. E. Williams
Mr and Mrs E. B. Stocking
Colonel and Mrs Rutherford
Miss Farrell
Mr and Mrs George E. Roberts
Senator Long, of Kansas, and Mrs Long
Mr Henry F. Blount, Vice-President American Security and Trust Co., and Mrs Blount
Mr R. S. Woodward, Jr.
Miss Carbo
Mr E. S. Barlow
Miss Gheen
Admiral and Mrs Prindle, U. S. Navy
Mr and Mrs Andrew B. Graham
Mr John B. Sleman, Sr.
Mr E. Quincy Smith
Mr John B. Sleman, Jr.
Miss Austin
Mr M. I. Weller
Senator Gallinger, of New Hampshire, and Mrs Gallinger
Mr Reuel Small
Mr Frank B. Stetson
Mr Charles S. Bradley
Mr Fred. G. Clapp
Admiral and Mrs Gheen, U. S. Navy
Mr and Mrs G. R. Putnam
Mr William Bowie
Col. and Mrs Robinson
Gen. James A. Buchanan
Mr and Mrs C. E. Grundsky
Hon. O. P. Austin, Chief Bureau of Statistics, and Mrs Austin
Mr F. C. Billard
Capt. W. V. Jacobs
Dr C. L. Billard
Miss Hendley
Mr Hendley
Mr Herndon Morsell
Mr A. B. Casselman
Mr F. W. Booth
Prof. and Mrs Humphreys, of Mount Weather Observatory
Mrs Breaux
Mr and Mrs Otto J. Luebkert
Ex-Senator and Mrs Thurston, of Nebraska
Mr Busby
Dr and Mrs George B. Welch
Mr J. T. Granger
Rev. and Mrs W. R. Turner
Mr and Mrs F. B. Eichelberger
General Ellis Spear
Mr Mattingly
Representative Brooks, of Colorado, and Mrs Brooks
Senator Pyles, of Washington
Mr John Joy Edson, President Washington Loan and Trust Company, and Mrs Edson
Mr Waernicke
Mr A. H. Chase
Mr and Mrs Bradbury
Mrs G. V. B. Moore
Mr Walter C. Thomas
Mr and Mrs Mesney
Mr and Mrs Buckey
Mr and Mrs Van Wickle
Mr Dennis
Mr S. I. Kimball, Superintendent of the Life Saving Service
Mr W. G. Dennis
Mr John W. Echols
Mr Edward R. Wood
Mr and Mrs Denney
Mr W. R. Smith
Mrs Eliza T. Ward
Mrs T. H. McKee
Mr James Penniman
Mr Charles P. Neill, Commissioner of Labor, and Mrs Neill
Mr and Mrs F. V. Coville
Mr John Oliver LaGorce

AN AWAKENED CONTINENT TO THE SOUTH OF US

By Hon. Elihu Root, Secretary of State

A LITTLE less than three centuries of colonial and national life have brought the people inhabiting the United States, by a process of evolution, natural and with the existing forces inevitable, to a point of distinct and radical change in their economic relations to the rest of mankind.

During the period now past the energy of our people, directed by the formative power created in our early population by heredity, by environment, by the struggle for existence, by individual independence, and by free institutions, has been devoted to the internal development of our own country. The surplus wealth produced by our labors has been applied immediately to reproduction in our own land. We have been cutting down forests and breaking virgin soil and fencing prairies and opening mines of coal and iron and copper and silver and gold, and building roads and canals and railroads and telegraph lines and cars and locomotives and mills and furnaces and school-houses and colleges and libraries and hospitals and asylums and public buildings and storehouses and shops and homes. We have been drawing on the resources of the world in capital and in labor to aid us in our work. We have gathered strength from every rich and powerful nation and expended it upon these home undertakings; into them we have poured hundreds of millions of money attracted from the investors of Europe. We have been always a debtor nation, borrowing from the rest of the world, drawing all possible energy towards us and concentrating it with our own energy upon our own enterprises. The engrossing pursuit of our own opportunities has excluded from our consideration and interest the enterprises and the possibilities of the outside world. Invention, discovery, the progress of science, capacity for organization, the enormous increase in the productive power of mankind, have accelerated our progress and have brought us to a result of development in every branch of internal industrial activity marvelous and unprecedented in the history of the world.

WE HAVE A NEW ROLE TO PLAY

Since the first election of President McKinley the people of the United States have for the first time accumulated a surplus of capital beyond the requirements of internal development. That surplus is increasing with extraordinary rapidity. We have paid our debts to Europe and have become a creditor instead of a debtor nation; we have faced about; we have left the ranks of the borrowing nations and have entered the ranks of the investing nations. Our surplus energy is beginning to look beyond our own borders, throughout the world, to find opportunity for the profitable use of our surplus capital, foreign markets for our manufactures, foreign mines to be developed, foreign bridges and railroads and public works to be built, foreign rivers to be turned into electric power and light. As in their several ways England and France and Germany have stood, so we in our own way are beginning to stand and must continue to stand towards the industrial enterprise of the world.

That we are not beginning our new role feebly is indicated by $1,518,561,666 of exports in the year 1905 as against

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$1,117,513,071 of imports, and by $1,743,864,500 exports in the year 1906 as against $1,226,563,843 of imports. Our first steps in the new field indeed are somewhat clumsy and unskilled. In our own vast country, with oceans on either side, we have had too little contact with foreign peoples readily to understand their customs or learn their languages; yet no one can doubt that we shall learn and shall understand and shall do our business abroad as we have done it at home with force and efficiency.

A NEWLY AWAKENED CONTINENT TO THE SOUTH OF US

Coincident with this change in the United States the progress of political development has been carrying the neighboring continent of South America out of the stage of militarism into the stage of industrialism. Throughout the greater part of that vast continent revolutions have ceased to be looked upon with favor or submitted to with indifference; the revolutionary general and the dictator are no longer the objects of admiration and imitation; civic virtues command the highest respect; the people point with satisfaction and pride to the stability of their governments, to the safety of property and the certainty of justice; nearly everywhere the people are eager for foreign capital to develop their natural resources and for foreign immigration to occupy their vacant land. Immediately before us, at exactly the right time, just as we are ready for it, great opportunities for peaceful commercial and industrial expansion to the south are presented.

Other investing nations are already in the field—England, France, Germany, Italy, Spain; but the field is so vast, the new demands are so great, the progress so rapid, that what other nations have done up to this time is but a slight advance in the race for the grand total. The opportunities are so large that figures fail to convey them. The area of this newly awakened continent is 7,502,848 square miles, more than two and one-half times as large as the United States without Alaska and more than double the United States including Alaska. A large part of this area lies within the temperate zone, with an equable and invigorating climate, free from extremes of either heat or cold. Farther north in the tropics are enormous expanses of high tablelands stretching from the Atlantic to the foothills of the Andes, and lifted far above the tropical heats; the fertile valleys of the western Cordilleras are cooled by perpetual snows even under the Equator; vast forests grow untouched from a soil of incredible richness. The plains of Argentina, the great uplands of Brazil; the mountain valleys of Chile, Peru, Equador, Bolivia, and Colombia are suited to the habitation of any race, however far to the north its origin may have been; hundreds of millions of men can find healthful homes and abundant sustenance in this great territory.

The population in 1900 was only 42,461,381, less than six to the square mile. The density of population was less than one-eighth of that in the State of Missouri, less than one-sixtieth of that in the State of Massachusetts, less than one-seventieth of that in England, less than one per cent of that in Belgium.

With this sparse population the production of wealth is already enormous. The latest trade statistics show exports from South America to foreign countries of $745,530,000, and imports of $499,858,600. Of the five hundred millions of goods that South America buys we sell them but $63,246,525, or 12.6 per cent. Of the seven hundred and forty-five millions that South America sells we buy $152,092,000, or 20.4 per cent, nearly two and a half times as much as we sell.

Their production is increasing by leaps and bounds. In eleven years the exports of Chile have increased forty-five per cent from $54,030,000, in 1894, to $78,840,000, in 1905. In eight years the exports of Peru have increased one hundred per cent from $13,899,000, in 1897, to $28,758,000, in 1905. In ten years the exports of Brazil have increased sixty-six

per cent from $134,062,000, in 1894, to $223,101,000, in 1905. In ten years the exports of Argentina have increased one hundred and sixty-eight per cent from $115,868,000, in 1895, to $311,544,000, in 1905.

This is only the beginning; the coffee and rubber of Brazil, the wheat and beef and hides of Argentina and Uraguay, the copper and nitrates of Chile, the copper and tin of Bolivia, the silver and gold and cotton and sugar of Peru, are but samples of what the soil and mines of that wonderful continent are capable of yielding. Ninety-seven per cent of the territory of South America is occupied by ten independent republics living under constitutions substantially copied or adapted from our own. Under the new conditions of tranquillity and security which prevail in most of them, their eager invitation to immigrants from the old world will not long pass unheeded.

ARGENTINE RECEIVES 200,000 IMMIGRANTS ANNUALLY

The pressure of population abroad will inevitably turn its streams of life and labor towards those fertile fields and valleys; the streams have already begun to flow; more than two hundred thousand immigrants entered the Argentine Republic last year; they are coming this year at the rate of over three hundred thousand. Many thousands of Germans have already settled in southern Brazil. They are most welcome in Brazil; they are good and useful citizens there as they are here; I hope that many more will come to Brazil and every other South American country, and add their vigorous industry and good citizenship to the upbuilding of their adopted home.

With the increase of population in such a field, under free institutions, with the fruits of labor and the rewards of enterprise secure, the production of wealth and the increase of purchasing power will afford a market for the commerce of the world worthy to rank even with the markets of the Orient as the goal of business enterprise.

SOUTH AMERICANS ARE COMPLEMENTARY TO US

The material resources of South America are in some important respects complementary to our own; that continent is weakest where North America is strongest as a field for manufactures; it has comparatively little coal and iron.

In many respects the people of the two continents are complementary to each other; the South American is polite, refined, cultivated, fond of literature and of expression and of the graces and charms of life, while the North American is strenuous, intense, utilitarian. Where we accumulate, they spend. While we have less of the cheerful philosophy which finds sources of happiness in the existing conditions of life, they have less of the inventive faculty which strives continually to increase the productive power of man and lower the cost of manufacture. The chief merits of the peoples of the two continents are different; their chief defects are different. Mutual intercourse and knowledge cannot fail to greatly benefit both; each can learn from the other; each can teach much to the other, and each can contribute greatly to the development and prosperity of the other. A large part of their products finds no domestic competition here; a large part of our products will find no domestic competition there. The typical conditions exist for that kind of trade which is profitable, honorable and beneficial to both parties.

The relations between the United States and South America have been chiefly political rather than commercial or personal. In the early days of the South American struggle for independence, the eloquence of Henry Clay awakened in the American people a generous sympathy for the patriots of the South as for brethren struggling in the common cause of liberty. The clear-eyed, judicious diplomacy of Richard Rush, the American Minister at the Court of St James, effected a complete understanding with Great Britain for concurrent action

in opposition to the designs of the Holy Alliance, already contemplating the partition of the Southern Continent among the great powers of continental Europe. The famous declaration of Monroe arrayed the organized and rapidly increasing power of the United States as an obstacle to European interference and made it forever plain that the cost of European aggression would be greater than any advantage which could be won even by successful aggression.

THE MONROE DOCTRINE AS SOUND TODAY AS 80 YEARS AGO

That great declaration was not the chance expression of the opinion or the feeling of the moment; it crystallized the sentiment for human liberty and human rights which has saved American idealism from the demoralization of narrow selfishness, and has given to American democracy its true world power in the virile potency of a great example. It responded to the instinct of self-preservation in an intensely practical people. It was the result of conference with Jefferson and Madison and John Quincy Adams and John C. Calhoun and William Wirt—a combination of political wisdom, experience, and skill not easily surpassed. The particular circumstances which led to the declaration no longer exist; no Holy Alliance now threatens to partition South America; no European colonization of the west coast threatens to exclude us from the Pacific. But those conditions were merely the occasion for the declaration of a principle of action.

Other occasions for the application of the principle have arisen since; it needs no prophetic vision to see that other occasions for its application may arise hereafter. The principle declared by Monroe is as wise an expression of sound political judgment today, as truthful a representation of the sentiments and instincts of the American people today, as living in its force as an effective rule of conduct whenever occasion shall arise, as it was on the 2d of December, 1823.

These great political services to South American independence, however, did not and could not in the nature of things create any relation between the people of South America and the people of the United States except a relation of political sympathy.

THE NEW ERA OF AMERICAN RELATIONS

Twenty-five years ago Mr Blaine, sanguine, resourceful, and gifted with that imagination which enlarges the historian's understanding of the past into the statesman's comprehension of the future, undertook to inaugurate a new era of American relations which should supplement political sympathy by personal acquaintance, by the intercourse of expanding trade, and by mutual helpfulness. As Secretary of State under President Arthur, he invited the American nations to a conference to be held on the 24th of November, 1882, for the purpose of considering and discussing the subject of preventing war between the nations of America. That invitation, abandoned by Mr Frelinghuysen, was renewed under Mr Cleveland, and on the 2d of October, 1889, Mr Blaine, again Secretary of State under President Harrison, had the singular good fortune to execute his former design and to open the sessions of the first American conference at Washington. In an address of wisdom and lofty spirit, which should ever give honor to his memory, he described the assembly as:

"An honorable, peaceful conference of seventeen independent American powers, in which all shall meet together on terms of absolute equality; a conference in which there can be no attempt to coerce a single delegate against his own conception of the interests of his nation; a conference which will permit no secret understanding on any subject, but will frankly publish to the world all its conclusions; a conference which will tolerate no spirit of conquest, but will aim to cultivate an American sympathy as broad as both continents; a conference which will form no selfish alliance against the older nations from which we are proud to claim

inheritance—a conference, in fine, which will seek nothing, propose nothing, endure nothing that is not, in the general sense of all the delegates, timely, wise and peaceful."

The policy which Blaine inaugurated has been continued; the Congress of the United States has approved it; subsequent Presidents have followed it. The first conference at Washington has been succeeded by a second conference in Mexico, and now by a third conference in Rio de Janeiro; and it is to be followed in years to come by further successive assemblies in which the representatives of all American States shall acquire better knowledge and more perfect understanding and be drawn together by the recognition of common interests and the kindly consideration and discussion of measures for mutual benefit.

BOTH NORTH AND SOUTH AMERICA HAVE GROWN UP TO BLAINE'S POLICY

Nevertheless, Mr Blaine was in advance of his time. In 1881 and 1889 neither had the United States reached a point where it could turn its energies away from its own internal development and direct them outward towards the development of foreign enterprises and foreign trade, nor had the South American countries reached the stage of stability in government and security for property necessary to their industrial development.

Now, however, the time has come; both North and South America have grown up to Blaine's policy; the production, the trade, the capital, the enterprise of the United States have before them the opportunity to follow, and they are free to follow, the pathway marked out by the far-sighted statesmanship of Blaine for the growth of America, North and South, in the peaceful prosperity of a mighty commerce.

To utilize this opportunity certain practical things must be done. For the most part these things must be done by a multitude of individual efforts; they cannot be done by government. Government may help to furnish facilities for the doing of them, but the facilities will be useless unless used by individuals; they cannot be done by resolutions of this or any other commercial body; resolutions are useless unless they stir individual business men to action in their own business affairs. The things needed have been fully and specifically set forth in many reports of efficient consuls and of highly competent agents of the Department of Commerce and Labor, and they have been described in countless newspapers and magazine articles; but all these things are worthless unless they are followed by individual action. I will indicate some of the matters to which every producer and merchant who desires South American trade should pay attention:

SOME ESSENTIALS OF SUCCESS IN THE SOUTH AMERICAN FIELD

1. He should learn what the South Americans want and conform his product to their wants. If they think they need heavy castings, he should give them heavy castings and not expect them to buy light ones because he thinks they are better. If they want coarse cottons, he should give them coarse cottons and not expect them to buy fine cottons. It may not pay today, but it will pay tomorrow. The tendency to standardize articles of manufacture may reduce the cost and promote convenience, but if the consumers on the River Plate demand a different standard from the consumers on the Mississippi, you must have two standards or lose one market.

2. Both for the purpose of learning what the South American people want and of securing their attention to your goods, you must have agents who speak the Spanish or Portuguese language. For this there are two reasons; one is that people can seldom really get at each other's minds through an interpreter, and the other is that nine times out of ten it is only through knowing the Spanish or Portuguese language that a North American comes to appreciate the admirable and attractive personal qualities of

the South American, and is thus able to establish that kindly and agreeable personal relation which is so potent in leading to business relations.

3. The American producer should arrange to conform his credit system to that prevailing in the country where he wishes to sell goods. There is no more money lost upon commercial credits in South America than there is in North America; but business men there have their own ways of doing business; they have to adapt the credits they receive to the credits they give. It is often inconvenient, disagreeable, and sometimes impossible for them to conform to our ways, and the requirement that they should do so is a serious obstacle to trade.

To understand credits it is, of course, necessary to know something about the character, trustworthiness, and commercial standing of the purchaser, and the American producer or merchant who would sell goods in South America must have some means of knowledge upon this subject. This leads naturally to the next observation I have to make.

4. The establishment of banks should be brought about. The Americans already engaged in South American trade could well afford to subscribe the capital and establish an American bank in each of the principal cities of South America. This is, first because nothing but very bad management could prevent such a bank from making money; capital is much needed in those cities, and six, eight and ten per cent can be obtained for money upon just as safe security as can be had in Kansas City, St Louis, or New York. It is also because the American bank would furnish a source of information as to the standing of the South American purchasers to whom credit may be extended, and because American banks would relieve American business in South America from the disadvantage which now exists of making all its financial transactions through Europe instead of directly with the United States. It is unfortunately true that among hundreds of thousands of possible customers the United States now stands in a position of assumed financial and business inferiority to the countries through whose banking houses all its business has to be done.

5. The American merchant should himself acquire, if he has not already done so, and should impress upon all his agents, that respect for the South American to which he is justly entitled and which is the essential requisite to respect from the South American. We are different in many ways as to character and methods. In dealing with all foreign people it is important to avoid the narrow and uninstructed prejudice which assumes that difference from ourselves denotes inferiority. There is nothing that we resent so quickly as an assumption of superiority or evidence of condescension in foreigners; there is nothing that the South Americans resent so quickly. The South Americans are our superiors in some respects; we are their superiors in other respects. We should show to them what is best in us and see what is best in them. Every agent of an American producer or merchant should be instructed that courtesy, politeness, kindly consideration are essential requisites for success in the South American trade.

6. The investment of American capital in South America under the direction of American experts should be promoted, not merely upon simple investment grounds, but as a means of creating and enlarging trade. For simple investment purposes the opportunities are innumerable. Good business judgment and good business management will be necessary there, of course, as they are necessary here; but given these, I believe that there is a vast number of enterprises awaiting capital in the more advanced countries of South America, capable of yielding great profits, and in which the property and the profits will be as safe as in the United States or Canada.

A good many such enterprises are already begun. I have found a graduate of the Massachusetts Institute of Tech-

nology, a graduate of the Columbia School of Mines and a graduate of Colonel Roosevelt's Rough Riders smelting copper close under the snow line of the Andes; I have ridden in an American car upon an American electric road, built by a New York engineer, in the heart of the coffee region of Brazil, and I have seen the waters of that river, along which Pizarro established his line of communication in the conquest of Peru, harnessed to American machinery to make light and power for the city of Lima. Every such point is the nucleus of American trade—the source of orders for American goods.

7. It is absolutely essential that the means of communication between the two countries should be improved and increased.

This underlies all other considerations and it applies both to the mail, the passenger and the freight services. Between all the principal South American ports and England, Germany, France, Spain, Italy lines of swift and commodious steamers ply regularly. There are five subsidized first-class mail and passenger lines between Buenos Aires and Europe; there is no such line between Buenos Aires and the United States. Within the past two years the German, the English and the Italian lines have been replacing their old steamers with new and swifter steamers of modern construction, accommodation and capacity.

In the year ending June 30, 1905, there entered the port of Rio de Janeiro steamers and sailing vessels flying the flag of Austria-Hungary 120, of Norway 142, of Italy 165, of Argentina 264, of France 349, of Germany 657, of Great Britain, 1,785, of the United States no steamers and seven sailing vessels, two of which were in distress!

An English firm runs a small steamer monthly between New York and Rio de Janeiro; the Panama Railroad Company runs steamers between New York and the Isthmus of Panama; the Brazilians are starting for themselves a line between Rio and New York; there are two or three foreign concerns running slow cargo boats, and there are some foreign tramp steamers. That is the sum total of American communications with South America beyond the Caribbean Sea.

NOT ONE AMERICAN STEAMSHIP RUNS TO ANY SOUTH AMERICAN PORT BEYOND THE CARIBBEAN

During the past summer I entered the ports of Para, Pernambuco, Bahia, Rio de Janeiro, Santos, Montevideo, Buenos Aires, Bahia Blanca, Punta Arenas, Lota, Valparaiso, Coquimbo, Tocopilla, Callao and Carthagena—all of the great ports and a large proportion of the secondary ports of the Southern Continent. I saw only one ship, besides the cruiser that carried me, flying the American flag.

The mails between South America and Europe are swift, regular and certain; between South America and the United States they are slow, irregular and uncertain. Six weeks is not an uncommon time for a letter to take between Buenos Aires or Valparaiso and New York. The merchant who wishes to order American goods cannot know when his order will be received or when it will be filled.

The freight charges between the South American cities and American cities are generally and substantially higher than between the same cities and Europe; at many points the deliveries of freight are uncertain and its condition upon arrival doubtful.

The passenger accommodations are such as to make a journey to the United States a trial to be endured and a journey to Europe a pleasure to be enjoyed. The best way to travel between the United States and both the southwest coast and the east coast of South America is to go by way of Europe, crossing the Atlantic twice. It is impossible that trade should prosper or intercourse increase or mutual knowledge grow to any great degree under such circumstances. The communication is worse now than it was twenty-five years ago. So long as it is left in the hands of our foreign competi-

tors in business we cannot reasonably look for any improvement. It is only reasonable to expect that European steamship lines shall be so managed as to promote European trade in South America rather than to promote the trade of the United States in South America.

This woeful deficiency in the means to carry on and enlarge our South American trade is but a part of the general decline and feebleness of the American merchant marine, which has reduced us from carrying over ninety per cent of our export trade in our own ships to the carriage of nine per cent of that trade in our own ships and dependence upon foreign shipowners for the carriage of ninety-one per cent. The true remedy and the only remedy is the establishment of American lines of steamships between the United States and the great ports of South America adequate to render fully as good service as is now afforded by the European lines between those ports and Europe. The substantial underlying fact was well stated in the resolution of this Trans-Mississippi Congress three years ago:

"That every ship is a missionary of trade; that steamship lines work for their own countries just as railroad lines work for their terminal points, and that it is as absurd for the United States to depend upon foreign ships to distribute its products as it would be for a department store to depend upon wagons of a competing house to deliver its goods."

How can this defect be remedied? The answer to this question must be found by ascertaining the cause of the decline of our merchant marine. Why is it that Americans have substantially retired from the foreign transport service? We are a nation of maritime traditions and facility; we are a nation of constructive capacity, competent to build ships; we are eminent, if not preëminent, in the construction of machinery; we have abundant capital seeking investment; we have courage and enterprise, shrinking from no competition in any field which we choose to enter. Why, then, have we retired from this field, in which we were once conspicuously successful?

I think the answer is twofold.

THE AMERICAN SAILORS RIGHTFULLY DEMAND THE AMERICAN SCALE OF LIVING

1. The higher wages and the greater cost of maintenance of American officers and crews make it impossible to compete on equal terms with foreign ships. The scale of living and the scale of pay of American sailors are fixed by the standard of wages and of living in the United States, and those are maintained at a high level by the protective tariff. The moment the American passes beyond the limits of his country and engages in ocean transportation he comes into competition with the lower foreign scale of wages and of living. Mr Joseph L. Bristow in his report upon trade conditions affecting the Panama Railroad, dated June 14, 1905, gives in detail the cost of operating an American steamship with a tonnage of approximately thirty-five hundred tons as compared with the cost of operating a specified German steamship of the same tonnage, and the differences aggregate $15,315 per annum greater cost for the American steamship than for the German, that is $4.37 per ton. He gives also in detail the cost of maintaining another American steamship with a tonnage of approximately twenty-five hundred tons as compared with the cost of operating a specified British steamship of the same tonnage, and the differences aggregate $18,289.68 per annum greater cost for the American steamship than for the British, that is $7.31 per ton. It is manifest that if the German steamship were content with a profit of less than $15,000 per annum, and the British with a profit of less than $18,000 per annum, the American ships would have to go out of business.

2. The principal maritime nations of the world, anxious to develop their trade, to promote their shipbuilding industry, to have at hand transports and auxiliary cruisers in case of war, are fostering their

steamship lines by the payment of subsidies. England is paying to her steamship lines between six and seven million dollars a year; it is estimated that since 1840 she has paid to them between two hundred and fifty and three hundred millions. The enormous development of her commerce, her preponderant share of the carrying trade of the world, and her shipyards crowded with construction orders from every part of the earth, indicate the success of her policy. France is paying about eight million dollars a year; Italy and Japan, between three and four million each; Germany, upon the initiative of Bismarck, is building up her trade with wonderful rapidity by heavy subventions to her steamship lines and by giving special differential rates of carriage over her railroads for merchandise shipped by those lines. Spain, Norway, Austria-Hungary, Canada all subsidize their own lines. It is estimated that about $28,000,000 a year are paid by our commercial competitors to their steamship lines.

Against these advantages to his competitor the American ship owner has to contend; and it is manifest that the subsidized ship can afford to carry freight at cost for a long enough period to drive him out of business.

We are living in a world not of natural competition, but of subsidized competition. State aid to steamship lines is as much a part of the commercial system of our day as state employment of consuls to promote business.

IT IS NOT A FAIR FIGHT

It will be observed that both of these disadvantages under which the American ship owner labors are artificial; they are created by governmental action, one by our own government in raising the standard of wages and living, by the protective tariff, the other by foreign governments in paying subsidies to their ships for the promotion of their own trade. For the American ship owner it is not a contest of intelligence, skill, industry and thrift against similar qualities in his competitor; it is a contest against his competitors and his competitors' governments and his own government also.

Plainly these disadvantages created by governmental action can be neutralized only by governmental action, and should be neutralized by such action.

What action ought our Government to take for the accomplishment of this just purpose? Three kinds of action have been advocated.

1. A law providing for free ships—that is, permitting Americans to buy ships in other countries and bring them under the American flag. Plainly this would not at all meet the difficulties which I have described. The only thing it would accomplish would be to overcome the excess in cost of building a ship in an American shipyard over the cost of building it in a foreign shipyard; but since all the materials which enter into an American ship are entirely relieved of duty, the difference in cost of construction is so slight as to be practically a negligible quantity and to afford no substantial obstacle to the revival of American shipping. The expedient of free ships, therefore, would be merely to sacrifice our American shipbuilding industry, which ought to be revived and enlarged with American shipping, and to sacrifice it without receiving any substantial benefit. It is to be observed that Germany, France, and Italy all have attempted to build up their own shipping by adopting the policy of free ships, have failed in the experiment, have abandoned it, and have adopted in its place the policy of subsidy.

2. It has been proposed to establish a discriminating tariff duty in favor of goods imported in American ships, that is to say, to impose higher duties upon goods imported in foreign ships than are imposed on goods imported in American ships. We tried that once many years ago and have abandoned it. In its place we have entered into treaties of commerce and navigation with the principal countries of the world expressly agreeing that no such discrimination shall be made between their vessels and ours. To sweep

away all those treaties and enter upon a war of commercial retaliation and reprisal for the sake of accomplishing indirectly what can be done directly should not be seriously considered.

3. There remains the third and obvious method: To neutralize the artificial disadvantages imposed upon American shipping through the action of our own government and foreign governments by an equivalent advantage in the form of a subsidy or subvention. In my opinion this is what should be done; it is the sensible and fair thing to do. It is what must be done if we would have a revival of our shipping and the desired development of our foreign trade. We cannot repeal the protective tariff; no political party dreams of repealing it; we do not wish to lower the standard of American living or American wages.

We should give back to the ship owner what we take away from him for the purpose of maintaining that standard, and unless we do give it back, we shall continue to go without ships.

How can the expenditure of public money for the improvement of rivers and harbors to promote trade be justified upon any grounds which do not also sustain this proposal? Would any one reverse the policy that granted aid to the Pacific railroads, the pioneers of our enormous internal commerce, the agencies that built up the great traffic which has enabled half a dozen other roads to be built in later years without assistance? Such subventions would not be gifts. They would be at once compensation for injuries inflicted upon American shipping by American laws and the consideration for benefits received by the whole American people—not the shippers or the shipbuilders or the sailors alone, but by every manufacturer, every miner, every farmer, every merchant whose prosperity depends upon a market for his products.

The provision for such just compensation should be carefully shaped and directed so that it will go to individual advantage only so far as the individual is enabled by it to earn a reasonable profit by building up the business of the country.

A MOST IMPORTANT MEASURE

A bill is now pending in Congress which contains such provisions; it has passed the Senate and is now before the House Committee on Merchant Marine and Fisheries; it is known as Senate Bill No. 529, Fifty-ninth Congress, first session. It provides specifically that the Postmaster General may pay to American steamships, of specified rates of speed, carrying mails upon a regular service, compensation not to exceed the following amounts: For a line from an Atlantic port to Brazil, monthly, $150,000 a year; for a line from an Atlantic port to Uruguay and Argentina, monthly, $187,500 a year; for a line from a Gulf port to Brazil, monthly, $137,500 a year; for a line from each of two Gulf ports and from New Orleans to Central America and the Isthmus of Panama, weekly, $75,000 a year; for a line from a Gulf port to Mexico, weekly, $50,000 a year; for a line from a Pacific Coast port to Mexico, Central America and the Isthmus of Panama, fortnightly, $120,000 a year. For these six regular lines a total of $720,000. The payments provided are no more than enough to give the American ships a fair living chance in the competition.

There are other wise and reasonable provisions in the bill relating to trade with the Orient, to tramp steamers and to a naval reserve, but I am now concerned with the provisions for trade to the South. The hope of such a trade lies chiefly in the passage of that bill.

Postmaster General Cortelyou, in his report for 1905, said:

"Congress has authorized the Postmaster General, by the act of 1891, to contract with the owners of American steamships for ocean mail service and has realized the impracticability of commanding suitable steamships in the interest of the postal service alone by requiring that such steamers shall be of a size, class, and equipment which will promote com-

merce and become available as auxiliary cruisers of the navy in case of need. The compensation allowed to such steamers is found to be wholly inadequate to secure the proposals contemplated; hence advertisements from time to time have failed to develop any bids for much-needed service. This is especially true in regard to several of the countries of South America with which we have cordial relations and which, for manifest reasons, should have direct mail connections with us. I refer to Brazil and countries south of it. Complaints of serious delay to mails for these countries have become frequent and emphatic, leading to the suggestion on the part of certain officials of the government that for the present, and until more satisfactory direct communication can be established, important mails should be dispatched to South America by way of European ports and on European steamers, which would not only involve the United States in the payment of double transit rates to a foreign country for the dispatch of its mails to countries of our own hemisphere, but might seriously embarrass the government in the exchange of important official and diplomatic correspondence.

"The fact that the government claims exclusive control of the transmission of letter mail throughout its own territory would seem to imply that it should secure and maintain the exclusive jurisdiction, when necessary, of its mails on the high seas. The unprecedented expansion of trade and foreign commerce justifies prompt consideration of an adequate foreign mail service."

THE U. S. GOVERNMENT NETS 100 PER CENT PROFIT ON ITS FOREIGN MAIL

It is difficult to believe, but it is true, that out of this faulty ocean mail service the government of the United States is making a large profit. The actual cost to the government last year of the ocean mail service to foreign countries other than Canada and Mexico was $2,965,624.21, while the proceeds realized by the government from postage between the United States and foreign countries other than Canada and Mexico was $6,008,807.53, leaving the profit to the United States of $3,043,183.32; that is to say, under existing law the government of the United States, having assumed the monopoly of carrying the mails for the people of the country, is making a profit of three million dollars per annum by rendering cheap and inefficient service. Every dollar of that three millions is made at the expense of the commerce of the United States. What can be plainer than that the government ought to expend at least the profits that it gets from the ocean mail service in making the ocean mail service efficient. One-quarter of those profits would establish all these lines which I have described between the United States and South and Central America and give us, besides a good mail service, enlarged markets for the producers and merchants of the United State who pay the postage from which the profits come.*

In his last message to Congress, President Roosevelt said:

"To the spread of our trade in peace and the defense of our flag in war a great and prosperous merchant marine is indispensable. We should have ships of our own and seamen of our own to convey our goods to neutral markets, and in case of need to reënforce our battle line. It cannot but be a source of regret and uneasiness to us that the lines of communication with our sister republics of South America should be chiefly under foreign control. It is not a good thing that American merchants and manufacturers should have to send their goods and letters to South America via Europe if they wish security and dispatch. Even on the Pacific, where our ships have held their own better than on the Atlantic, our merchant flag is now threatened through the liberal aid bestowed by other govern-

*There would be some modification of these figures if the cost of getting the mails to and from the exchange offices were charged against the account; but this is not separable from the general domestic cost and would not materially change the result.

ments on their own steam lines. I ask your earnest consideration of the report with which the Merchant Marine Commission has followed its long and careful inquiry."

The bill now pending in the House is a bill framed upon the report of that Merchant Marine Commission. The question whether it shall become a law depends upon your Representatives in the House. You have the judgment of the Postmaster General, you have the judgment of the Senate, you have the judgment of the President; if you agree with these judgments and wish the bill which embodies them to become a law, say so to your Representatives. Say it to them individually and directly, for it is your right to advise them and it will be their pleasure to hear from you what legislation the interests of their constituents demand.

The great body of Congressmen are always sincerely desirous to meet the just wishes of their constituents and to do what is for the public interest; but in this great country they are continually assailed by innumerable expressions of private opinion and by innumerable demands for the expenditure of public money; they come to discriminate very clearly between private opinion and public opinion and between real public opinion and the manufactured appearance of public opinion; they know that when there is a real demand for any kind of legislation it will make itself known to them through a multitude of individual voices. Resolutions of commercial bodies frequently indicate nothing except that the proposer of the resolution has a positive opinion and that no one else has interest enough in the subject to oppose it. Such resolutions by themselves, therefore, have comparatively little effect; they are effective only when the support of individual expressions shows that they really represent a genuine and general opinion.

It is for you and the business men all over the country whom you represent to show to the Representatives in Congress that the producing and commercial interests of the country really desire a practical measure to enlarge the markets and increase the foreign trade of the United States by enabling American shipping to overcome the disadvantages imposed upon it by foreign governments for the benefit of their trade and by our government for the benefit of our home industry.

FIGHTING THE POLAR ICE

IN "Fighting the Polar Ice," just published by Messrs Doubleday, Page & Co., Mr Fiala gives a graphic narrative of the Ziegler Polar Expedition of 1903-1905, of which he was the commander. The scientific work of this expedition, it will be remembered, was under the direction of the National Geographic Society. The expedition failed in its object of getting to the Pole, reaching only 82°, owing to wide open leads in the ice, succeeded by immense pressure ridges; but their two years' stay in the Far North was amply repaid by detailed explorations of previously uncharted portions of the Franz Josef Archipelago and by a series of magnetic and meteorological observations by Messrs W. J. Peters and R. W. Porter, which from their exactness and continuity have proved immensely valuable. The Scientific Report is in press and will be published shortly by the National Geographic Society.

The expedition left Norway early in July, 1903, but owing to the great amount of ice encountered failed to reach Teplitz Bay, in Franz Josef Land, before the end of August.

As a result, they had not time before the darkness set in to discharge the supplies, and were therefore compelled to

"WE CROSSED THE ARCTIC CIRCLE, AND ALL MEMBERS OF THE EXPEDITION WHO HAD NOT CROSSED THE PARALLEL BEFORE, WERE SEIZED BY THEIR COMRADES WHO HAD, AND INITIATED AS POLAR EXPLORERS BY BEING THROWN OVERBOARD WHILE THE STEAMER WAS IN MOTION, THEIR SAFETY FIRST INSURED BY A LONG LINE MADE FAST AROUND THEIR WAISTS."

This and the following photographs are copyrighted by Anthony Fiala.

keep their ship in an open roadstead, where she was finally crushed and sunk by the ice with more than half the provisions and coal. What they had taken ashore, however, was sufficient for one year.

The failure of the relief ship to appear in 1904 would have seriously embarrassed the party if it had not been for the abundant stores cached at Cape Flora by the Duke of Abruzzi and a vein of coal found by Assistant Engineer Vedoe 600 feet up the talus. The coal burned freely. Twenty tons of it were mined out of the frozen clay and carried down the steep talus on the backs of the men.

Mr Fiala writes very entertainingly, his power of description being exceedingly realistic. Particularly vivid are the chapters describing the grinding of the ship by the immense fields of ice which finally engulfed her; and the march in the blackness of an arctic night from Camp Ziegler to Camp Abruzzi, a distance of 200 miles. The lowest temperature recorded was 60.2 below zero (Fahr.), on January 5, 1905.

The volume is magnificently illustrated from photographs by Mr Fiala, the panoramic pictures giving us a better idea of the difficulties of dragging sledges over the polar ice than any pictures heretofore published.

"It is a curious fact that when one dog has antagonized the others the only way to save him from destruction later on is to chain him. Then the other dogs let him alone. Unfortunately for us, the dogs that seemed to incur the enmity of their fellows were the large, strong animals—the bullies and fighters. There seemed to be a degree of justice in their judgments. From close observation, I found that the dogs generally forgave a bite on the head or body, while an attack

HAULING THE CARCASS OF A POLAR BEAR ABOARD THE SHIP

on the legs seemed to be considered foul play and must be paid for by the life of the offending canine—the whole pack uniting in his execution.

"The one important point in which our equipment differed radically from that prepared for other attempts over the polar ice was in the use of ponies. These tough little animals are accustomed to the very lowest temperatures experienced in the steppes of Siberia, some parts of which are considered the coldest places of the earth. They are also accustomed to forcing their way through deep snows and across frozen rivers whose shores are lined with broken ice and deep drifts. They had been used first by Jackson, who believed them superior to dog teams and used them in preference to dogs on his trips of exploration and survey through the Franz Josef Archipelago.

"On smooth ice the dogs traveled faster than their rivals, but as soon as they struck rough going, the ponies outdistanced the dogs easily, at the same time dragging heavier loads. The men driving the dog teams were tired out at the end of a day's march by the constant exertion in helping the dogs pull their loads up grades and over ice-blocks, but it was seldom that the ponies required assistance.

"Over 120 polar bears were killed during our two years' stay in the Franz Josef Archipelago. Scurvy was unknown and the general health of the party was good.

"During the summer our party secured seventeen bears, and we luxuriated in bear steaks fried in butter. Most of the men enjoyed the meat, which was not unlike beef when prepared carefully, by cutting away all fat before frying. The fat gave the meat a rancid taste.

"In the nesting time of the gulls and loons, several of the sailors went up the talus daily, dragging with them a long ladder that they had constructed and, at the risk of their lives, clambered up the precipitous side of the great rock and robbed the nests. Many of the eggs were fresh, and when fried with the ham we had found in the Duke's cache gave us a breakfast not to be despised.

"Eight brant and several hundred loons were shot and added to our larder

"LOUISE"

and sixteen great walruses and about the same number of seals. Walrus liver was considered a delicacy, but the meat proper was rather tough and made one think he was dining on automobile tires."

The party also shot a number of ptarmigan, which is interesting as the first recorded appearance of these birds in the archipelago. Mr Fiala pays a well-deserved tribute to Mr W. S. Champ, the leader of the relief expedition of 1905.

This volume is the fourth of the Geographical Library published by Doubleday, Page & Co. The fifth, "Nearest the Pole," by Commander Robert E. Peary, will appear in the early spring.

GEOGRAPHIC LITERATURE

Flashlights in the Jungle: A record of hunting adventures and of studies in wild life in equatorial East Africa. By C. G. Schillings; translated by Frederick Whyte. Illustrated with 302 of the author's "untouched" photographs taken by day and night. New York: Doubleday, Page & Company. 1906. $3.80 *net.*

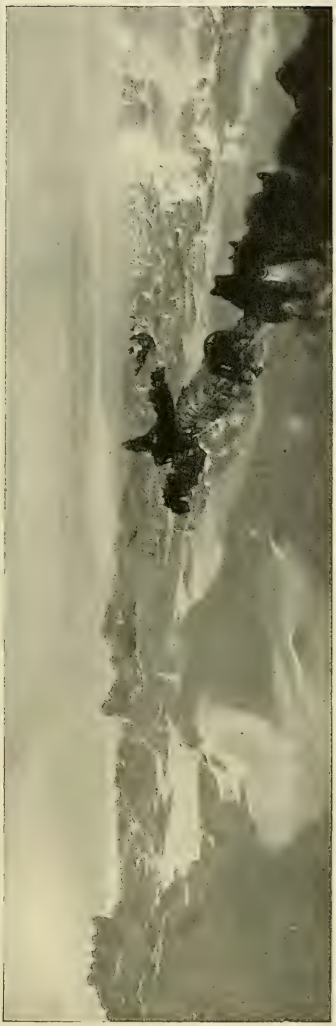
The most remarkable part of this very interesting book are the pictures which are snapshots at wild animals. Particularly wonderful are the flashlights of "lions killing an ox" (393) and of three full-grown lionesses (356), and still another of a lioness about to spring upon a donkey (378). There is also a remarkable series of flashlights of groups of zebra drinking at night (333, 337, 323) and a picture of a rhinoceros with its young (231), and two really wonderful pictures taken by daylight at fifteen paces of rhinoceroses bathing (205, 206). There is another series of giraffes stalking through the forest, taken by daylight (307, 321). The book is in fact full of rare and unique pictures of all sorts of animals and is worth many times the price for the pictures alone.

Herr Schillings' experiences show that photographing was often dangerous work. The following description of photographing rhinoceroses is quoted: "Accompanied now by only two of my bearers and two Masai, I succeeded in approaching warily within 120 yards of them. I had taken several pictures successfully with my telephoto-lens, when suddenly for some reason the animals stood up quickly, both together, as is their wont. Almost simultaneously the farther of the two, an old cow, began moving the front part of the body to and fro, and then, followed by the bull with head high in the air, came straight for me, full gallop. I had instinctively felt what would happen, and in a moment my rifle was in my hands and my camera passed to my bearers. I fired six shots and succeeded in bringing down both animals twice as they rushed toward me. Great furrows in the sand of the velt showed where they fell.

"My final shot I fired in the absolute certainty that my last hour had come. It hit the cow in the nape of the neck, and at the same moment I sprang to the right, to the other side of the brier bush. With astounding agility the rhinoceroses followed me, and half way round the bush I found myself between the two animals. It seems incredible, now that I tell the tale in

CROSSING A LEAD IN THE CHANNEL ICE—HAULING A TEAM OF DOGS THROUGH THE WATER

THE PONY COLUMN CROSSING RUDOLF ISLAND GLACIER



Copyright, 1906, by Anthony Fiala.

"WE SEEMED TO BE IN AN IMMENSE RIVER OF BROKEN ICE"

cold blood, but in that same instant my shots took effect mortally and both rhinoceroses collapsed."

Dr Schillings' pictures will constantly enhance in value, for the time is not distant when the huge beasts he so vividly describes will be as rare as the American buffalo.

E. M. G.

The Uncompahgre Valley and the Gunnison Tunnel. By Barton W. Marsh. Pp. 151. 5¼ by 8¼ inches. Illustrated. Montrose, Colo.: Marsh and Torrence. 1905.

The compilers of this volume state in their preface that their object is "to assist those who contemplate making a change of location, as well as for the distribution of accurate knowledge of this part of the country." Useful information is given about the situation and surroundings of the valley, resources and products of the land, present water supply, climate, towns and industries, educational advantages, and finally the advantages of irrigation by turning the waters of the Uncompahgre River into the valley by means of the Gunnison Tunnel.

NATIONAL GEOGRAPHIC SOCIETY

January 4—"German East Africa." By Dr Louis Livingstone Seaman, of New York. Illustrated.

January 18—"Camping Expeditions in the Canadian Rockies." By Mr Howard Du Bois.

January 25—"Bolivia—a Country Without a Debt." By the Bolivian Minister, Señor F. Calderon. Illustrated.

February 1—"The Rising Pacific Empire." By Hon. George C. Perkins, U. S. Senator from California.

February 8—"The Guianas." By Prof. Angelo Heilprin, of Yale University. Illustrated.

February 15—"Ten Years of Polar Work; or, What We Know and What We Want to Know." By Mr Herbert L. Bridgman, Secretary of the Peary Arctic Club. Illustrated.

February 19—"Two Thousand Miles in the Saddle through Colombia and Ecuador." By Hon. John Barrett, U. S. Minister to Colombia. Illustrated.

March 1—"Santo Domingo and Haiti." By Rear Admiral Chester, U. S. Navy. Illustrated.

March 15—"The Regeneration of Korea." By Mr George Kennan. Illustrated.

March 21—"Our Immigrants: Where They Come From, What They Are, and What They Do After They Get Here." By Hon. F. P. Sargent, Commissioner General of Immigration. Illustrated.

March 23—"Queer Methods of Travel in Curious Corners of the World." By Hon. O. P. Austin, Chief Bureau of Statistics. Illustrated.

March 29—"Mexico—the Treasure-house of the World." By Mr N. H. Darton, of the U. S. Geological Survey. Illustrated.

April 5—"A Popular Explanation of Earthquakes and Volcanoes." By Dr G. K. Gilbert, of the U. S. Geological Survey. Illustrated.

April 12—"Captain John Smith and Old Jamestown." By Mr. W. W. Ellsworth, Secretary of the Century Co.

Announcements will be made later of addresses by Commander Robert E. Peary, U. S. Navy, who has recently attained "Farthest North," and by Dr F. A. Cook, of Brooklyn, who has accomplished the first ascent of Mount McKinley, the highest mountain in North America.

SCIENTIFIC MEETINGS

The meetings of this course will be held at the home of the Society, Hubbard Memorial Hall, Sixteenth and M streets, at 8 p. m., on the following dates:

January 11—Annual Meeting. "Aboriginal Agriculture in Guatemala." By Mr O. F. Cook, of the U. S. Department of Agriculture. Illustrated.

January 22—"The Coal Lands of the U. S. Public Domain." By Mr M. R. Campbell, of the U. S. Geological Survey. Illustrated.

February 9—"A Visit to Sumatra." By Mr George H. Peters, of the U. S. Naval Observatory. Illustrated.

February 18—"Reclaiming the Desert." By Mr C. J. Blanchard, of the U. S. Reclamation Service. Illustrated. The Reclamation Service has a fund of $40,000,000, which is being invested in irrigation works.

February 22—"Reclaiming the Swamp Lands of the United States." By Mr H. M. Wilson, of the U. S. Geological Survey. Illustrated.

February 28—"Acclimatizing Fishes — or Transplanting Fishes from the Atlantic to the Pacific, and Vice Versa, etc." By Dr Hugh M. Smith, Deputy Commissioner, Bureau of Fisheries. Illustrated.

March 8—"Twenty Years in Beirut and Damascus; or, The Syria of Today." By Rev. F. E. Hoskins. Illustrated.

March 11.—"The U. S. Forest Service." By Mr Gifford Pinchot, Forester. Illustrated. The Forest Service has charge of 114,606,058 acres of forest land, worth $400,000,000.

March 22—"Utilizing the Surface Waters of the United States for Power." By Mr H. A. Pressey, C. E. Illustrated.

April 6—"The South Sea Islanders." By Mr A. B. Alexander, of the U. S. Bureau of Fisheries. Illustrated.

April 15—"Photographs of Wild Game Taken by Themselves." By Hon. George Shiras, 3d. Illustrated.

April 19—"A Trip to Argentine and Paraguay." By Mr John W. Titcomb, of the U. S. Bureau of Fisheries. Illustrated.

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HOW LONG WILL OUR COAL RESERVES LAST?
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POLAR PHOTOGRAPHY
By ANTHONY FIALA

Notes on the Forest Service (Illustrated) and Geographic Literature

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Gathering Cacao Pods

La Clementina hacienda, Ecuador, the biggest chocolate plantation in the world. The trees are under constant cultivation and are continually growing more prolific. Laborers receive 80 cents to $1.00 (silver) per day, with house-rent free. 200 are employed all the year and 150 additional during harvest season on this plantation.

Vol. XVIII, No. 2 WASHINGTON February, 1907

THE NATIONAL GEOGRAPHIC MAGAZINE

BEAUTIFUL ECUADOR*

By Hon. Joseph Lee, U. S. Minister to Ecuador

THE Republic of Ecuador lies at the northwestern corner of the South American continent, between Colombia and Peru. As its name implies, it is situated upon the Equator.

Ecuador possesses an area of 429,000 square miles, including the Galapagos Archipelago. It is nearly twice the size of France and as large as Texas, New York, Pennsylvania, and Nebraska combined. The population is 1,500,000. Although the country is comprised between one degree north and four degrees south latitude, almost every variation of climate is obtainable, from the torrid lands of the coast to the chilly plains, at an elevation of 12,000 feet, at the foot of the snow-clad peaks of the Andes.

Both the eastern and western ranges of the Andes traverse the Republic. Between these ranges lie extensive high valleys yielding the products of the Temperate Zone. To the west of the Cordillera stretch the low tropical lands on the Pacific, and to the east the country gradually descends to the low Amazon Valley and the frontiers of Brazil.

Guayaquil, the principal seaport of the Republic, is situated on the River Guayas, the most important stream in South America emptying into the Pacific, about sixty miles above its mouth. It has a population of 50,000. It is the emporium of Ecuador. All imports and exports pass through Guayaquil. The houses are built of wood, owing to the lack of other material. They are constructed in the southern style, with balconies protruding over the sidewalks and resting upon wooden pillars, thus forming piazzas which afford protection against sun and rain. As fires under the circumstances are particularly dangerous, Guayaquil has perhaps a more extensive fire department than any city of its size, and ample reservoirs of water on a hill behind the town. It is improbable that Guayaquil will ever again be visited by such disastrous conflagrations as in the past.

GUAYAQUIL

The hospitals of Guayaquil are as complete as any in South America. The great new General Hospital, with its modern appliances, compares most favorably with Ancon Hospital at Panama. Although the cathedral, the churches, the great municipal buildings, and theaters are built of wood, they are imposing and are decorated in perfect taste. The Union Club of Guayaquil is, with

*An address to the National Geographic Society November 30, 1906.

the exception of the Hongkong Club, the best I have ever seen in the tropics. Under the bright light of the moon, these buildings appear to be constructed of rare marbles. The public squares are beautifully kept and filled with rare specimens of the rich vegetation of Ecuador.

The harbor is always busy with shipping. Two steamers each week sail for Panama and two arrive from the Isthmus. Fleets of tugboats, lighters, canoes, and balsas cover the water. The canoes, laden deep with fruit and country produce, come down river on the swift tide and return on the turn of the tide with scarcely the necessity of moving a paddle. The balsas are used to a great extent. They are a maritime contrivance invented by the ancient Peruvians and made of five, seven, and nine trunks of an exceedingly light tree called balsa, in sizes as required. Large balsas go with safety to sea as far as Paita, in Peru. The logs are lashed together with vines, and are fastened so firmly that they can ride almost any sea. The whole structure adapts itself to the waves, and no water rises between the logs. Houses are generally built upon them and form homes for a literally "floating population."

The dry season lasts from June to December. The weather is very pleasant and the nights and mornings are often cold. The mean temperature of Guayaquil is about 78 degrees.

On clear summer days, Chimborazo may be seen, rising 21,000 feet above the long chain of the Cordillera, covered with ice and snow whose dazzling whiteness is intersected by black lines formed by the sharp edges of frightful rocks upon which the snow cannot gather.

Guayaquil exports one-third of the world's supply of cocoa. It is raised along the Guayas River and its tributaries and is the principal staple of Guayaquil. Ivory nuts, from which bone buttons of commerce are made, are exported in enormous quantities. Panama hats, so called because they are distributed to the United States and Europe by way of the Isthmus of Panama, are manufactured in the Province of Manabi. The lowlands of the coast also produce cinchona bark, from which we obtain quinine (Countess of Chinchon), rice, coffee, sugar, tobacco, rubber, copal gum, vanilla, sarsaparilla, salt, petroleum, and cotton. It is interesting to note that during our civil war England was supplied with cotton from Ecuador. Of course, every variety of tropical fruit is produced and fine timber for house and ship building.

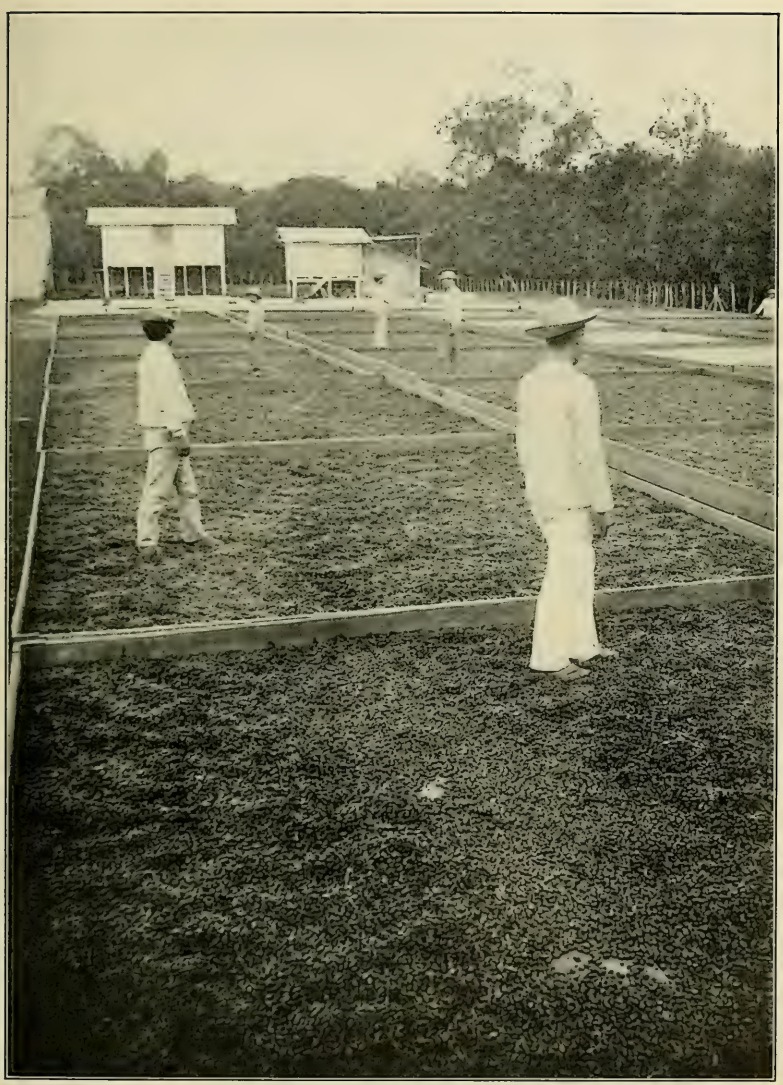
The daily papers of Guayaquil, *The Nacion, Telegrafo, Grito del Pueblo,* and *Tiempo,* are well patronized, well published, and of much influence. A satisfactory daily telegraphic service is maintained with the rest of the world. It is to be regretted that our newspapers do not devote an equivalent amount of space to events in South America.

Across the river from Guayaquil is Duran, the terminus of the Guayaquil and Quito Railroad, a company incorporated under the laws of the State of New Jersey. This railroad, built by American engineers, is completed for a distance of 140 miles and rises to a height of 12,000 feet, under the shadow of Chimborazo. The road bed is leveled into the city of Quito, 260 miles from the coast, and track is being laid at the present time at the rate of a mile per day.

ASCENDING THE ANDES

Leaving Duran at 7 a. m., the train proceeds over flat and gently rising country to the foothills of the Andes. In the level country are the great sugar estates, stretching for miles on either side of the track and equipped with lines of miniature railway for hauling cane and with large sugar factories. Leaving the plains, the ascent is gradual through dense tropical forests plentifully watered by streams and cascades which can supply unlimited water power.

At an elevation of from 4,000 to 5,000 feet there rises a mass of colossal, bald, rounded hills, almost shutting out the sunlight, and it appears impossible that the railroad can proceed further. The



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Drying Cacao Beans in the Sun

La Clementina plantation, Ecuador, where 25,000 pounds are produced yearly for American and European chocolate factories. When the pods are first opened the beans and enveloping pulp are creamy white, but they grow brown by exposure to sun and air. The beans shown here are spread on bamboo matting. The workmen rake them over once in a while by scuffling through them with bare feet to ensure even drying. The trees in the distance are cacao trees, of which there are 3,000 acres in this one estate.

mountains seem an unsurmountable wall 9,000 or 10,000 feet high. But American engineers have found a way and have accomplished one of the most difficult feats known in railroad construction. A sugar-loaf peak stands out in front of the towering hills. Cut zigzag in the sheer face of the granite, a switchback of four levels has solved the problem of rising to 9,000 feet. This level attained, the line advances through volcanic country, seamed with ravines and surrounded by sulphur-covered hills, until a similar cul-de-sac is reached. This in turn is surmounted by means of a similar switchback loop with a grade of 7 per cent, and we reach the Pass of Palmyra, on the roof of the world, at 12,000 feet. Wild wastes of shifting sand surround the track. Stiff grass, like rushes on the sea-shore, is the only vegetation. Fossil shells are found here, and the general appearance of the country is that of the sea-coast.

From this point there is a gradual descent until the present end of the road is reached at Cajabamba, 11,000 feet above the level of the sea and at the foot of mighty Chimborazo. At this place there are some of the few existing remains of buildings erected by the ancient Incas. They are built of great masses of stone fastened together with cement. The stone can be broken, but it is impossible to make any impression upon the cement. Strange to relate, I found living here a former Rough Rider, whom I had known in Cuba. He is engaged in the purchase of hides for the New York market.

It is necessary to spend the night in this village and to set out for Quito early next morning by automobile or diligence. I have always found it more satisfactory to travel by diligence. In this way baggage can accompany the traveler and a long wait at the journey's end is avoided.

The wagons are drawn by teams of five or six miles. Sixty mules, with changes, are used to reach Quito. Two drivers occupy the box seat, one furnished with a long-handled whip for the leaders, the other with a short whip for the wheelers. The animals are urged on with whistles and shouts without intermission. It is the most thrilling, exciting, and hair-raising locomotion I know. The mules are kept at full gallop down the long slopes of the Andes. It is often as much as they can do to keep ahead of the coach. However, I never heard of an accident. The drivers are men long trained in the business and do not know what fear is.

Formerly, before the days of the railroad and carriage road, it took ten days on mule back from Guayaquil to Quito; now by rail and coach the time is three days. I have made the journey with automobile and train in 20 hours.

A LAND MADE FOR GIANTS

The country is on a colossal scale. It seems a land made for giants. High in the air, the tops of the rounded hills are one patchwork of cultivated fields. At the foot of the hills lie smiling green valleys. There is abundant water and the dry places are well irrigated. Along the roadside water is carried for long distances by means of tunnels cut in the volcanic soil, with arched openings at certain intervals. The scarlet wool ponchos worn by the Indian laborers make it possible to pick them out, in the marvelous clear atmosphere, on the hills and in the valleys at surprising distances.

It is necessary to spend the night at the city of Ambato (8,000 feet). The town lies in a deep cauldron. The climate is delightful. Here apples, plums, and peaches flourish as well as the vegetables and cereals of the Temperate Zone. Ambato has several cotton mills, producing the coarse white cotton cloth universally used by the Indians for shirts and wide baggy trousers. Water power is abundant and the mills pay well. Ambato is also the headquarters for the trade from the Oriente, or the lowlands towards the east stretching to the valley of the Amazon. A line for a railroad to tap this district, rich in rubber and gold, has been surveyed and work will begin soon.

Leaving Ambato in the early morning, we can see one of the most glorious

sights of the world—sunrise on Chimborazo. The majestic giant stands out in the dawn, his mantle of snow washed with crimson and gold. The road winds over gigantic hills, around precipices, and down steep descents until we reach the great plain of Latacunga, stretching to the foot of dread Cotopaxi.

The fields as well as the broad roads crossing the wide valleys are inclosed by adobe walls surmounted by the broad-leaved American aloe. The aloe, sometimes called the century plant, is one of the most useful and important plants in the country. It is an erroneous idea that it flowers only once in a hundred years. The Indians thatch their huts with its leaves. The leaves when tapped yield syrup; they can also be used as soap, and the spines as pins. The fiber is woven into sacks, and from it are made the coarse sandals worn by the common people. The tall flower stalks are used for beams and ladders. The flowers, boiled and soaked in vinegar, make an agreeable pickle.

The cochineal is found in abundance upon the leaves of the plentiful cactus. Its name is derived from its supposed resemblance to a little pig (cochinillo). It is used by the Indians for dyeing ponchos and shawls.

As we approach the city of Latacunga the country becomes more sterile. The plain is covered with volcanic sand and pumicestone, indicating the neighborhood of Cotopaxi. The houses and churches are built of pumicestone thrown out by the mountain, which in the past has caused much destruction to this part of the country.

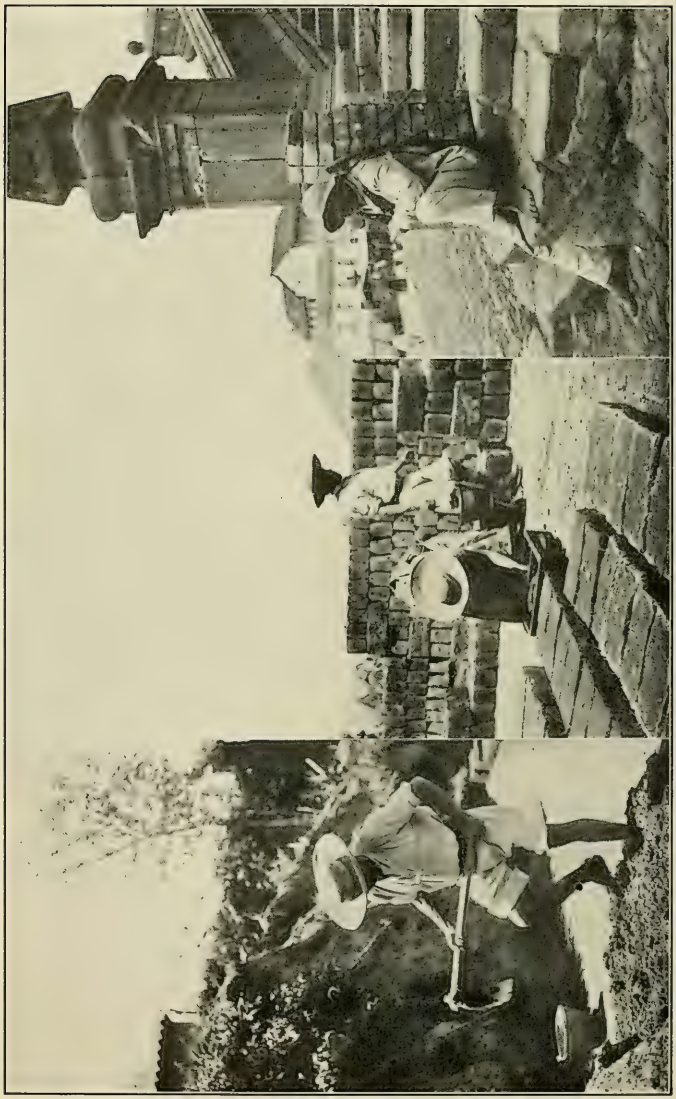
There is a legend that the great earthquake of 1698 was predicted by a priest seven years before it took place. The Carmelite nuns of Latacunga believed in the prophecy and slept in tents in their garden for seven years. The convent fell, but the nuns were saved.

Latacunga is the starting point of the most romantic gold legend in Ecuador. The lost treasure of the Incas is supposed to be hidden in the neighboring hills. One Valverde, a Spaniard, was informed of the secret by his sweetheart, an Inca maiden, and he became suddenly very rich. He left a description and guide of the hiding place. This document was preserved in the archives of the city until it was stolen. Many expeditions have been made in search of the lost treasure, but without success.

From this city we journey over rolling country to the foot of Cotopaxi (18,890

Water Carrier

feet). The mountain presents a beautiful appearance, clad in its robe of snow. Its shape is that of a regular truncated cone with a flat summit. The crater is uninterrupted in activity, and volumes of white and gray smoke continually issue from it. Generally the smoke assumes the form of an enormous tree, with trunk and branches, until a current of air tears it away from the mountain and it floats



Making Sun-baked Bricks in the Andes

away a cloud, while by night the smoke forms a pillar of fire. Near the snow-line is a huge mass of rock called the Inca's head. According to legend, this was the original summit of the mountain, torn off and hurled down by an eruption on the day the Inca, Atahualpa, was executed by the Viceroy of Peru.

After crossing the high pass of Chasqui, above the clouds, the road lies through rich pastures and fertile fields. The green pastures of the beautiful valley of Machachi spread around us, dotted with countless herds of cattle and horses. Beautiful villas set in gardens and groups of trees nestle at the foot of great hills.

Houses are closer together as we near Quito, the capital. Numberless Indians, men and women, carrying burdens or driving laden mules, form an endless procession. For the entire length of the great Ecuadorian highway, human beings are always in sight.

The Indians carry everything on their backs. The load is supported by a strap passing across the forehead. Their strength lies in the muscles of the neck, not in their arms. Their gait is a dog trot, which they can keep up all day. They are very polite and submissive.

A SNOW-WHITE CITY

Quito is built in a bowl-shaped valley, at the foot of Mount Pichincha. The altitude of the city is 9,600 feet above the sea. The mountain rises in the background to a height of 16,000 feet. The view which presents itself from the summit of this mountain is one of the most superb and imposing possible to conceive. Twenty snow-clad peaks rise before you, ranging from 15,000 to 22,000 feet. It is truly a Council of the Patriarchs of the Andes.

There are three entrances to the city—two from the south and one from the north. We enter from the south by a picturesque bridge spanning the Machangara River.

The direct rays of the equatorial sun are white as lime-light, and the first impression of Quito is that of a snow-white city, relieved by roofs of rich red tiles. In the streets and plazas are thousands of people, continually moving. The majority are Indians in scarlet or orange ponchos, wide white cotton trousers, and broad-brimmed white felt hats. There are Indians from a hundred different villages, marked by the cut of the hair, the turn of a hat, or the shape of a poncho. The streets are thronged from morning to evening with mules, horses, oxen, donkeys, and llamas with loads of every description.

Ladies in smart victorias, drawn by Chilian or native horses, drive to and from the shops filled with merchandise from Paris, New York, London, Vienna, and Berlin. Handsome officers in full regimentals stroll along the streets. Gentlemen in frock coats and top-hats are everywhere.

The city is traversed from east to west by two deep ravines, through which Pichincha sends down its torrents of melted snow. The land upon which the city is built is, in shape, like the inside of an oval bowl, at the bottom of which is the Plaza Mayor. The course of the streets is generally regular, running east and west and north and south. The streets are paved with cobbles. The houses, of stone and brick, are mostly built in the Spanish-Moorish style, with courtyards within. The roofs project over the sidewalk and afford protection from rain. Balconies overhang the streets from every window. The ground floor on the street has no connection with the rest of the house and is usually occupied by shops. The entrance is always high enough to admit a mounted horseman with ease. Around the courtyards are galleries, supported by arches or pillars. The living rooms open upon these galleries. Servants are cheap and faithful.

There are several good hotels in Quito—the Royal Palace, Hotel de Paris, Hotel Americano, and the Casa Azul.

The people of Quito are charming, courteous, and hospitable. I do not know any city of its size which contains as

many intelligent and cultivated people. Their hospitality is proverbial. I have continually received presents of sweetmeats, butter, cakes, venison, and even fish. There are no fish in or near Quito. They must be brought from Guayaquil frozen in blocks of ice—a journey of six days on mule back. I shall always be indebted to my courteous, cultivated friends of Quito for their constant kindness to me.

The population of Quito is computed to be about 70,000. Being the capital of the Republic, the government buildings and offices are here and also the presidential palace. The handsome government and municipal buildings, the bishop's palace, and the cathedral surround the great plaza. There are many beautiful churches and convents in Quito. The church of the Jesuits is superb, with its interior a mass of scarlet and real gold. Singers from Europe are attached to the choir. Here in the capital, above the clouds, is one of the prettiest theaters in South America.

The *Commercio* and *Tiempo,* the leading newspapers, are progressive, well edited, and influential.

The mean temperature of the city is about 60 degrees. The thermometer scarcely ever rises above 70 degrees or sinks below 50. The mornings and evenings are cool, the middle of the day warm. The climate is delightful—never hot, never cold—a perpetual early spring. Consumption and pulmonary diseases are practically unknown. Many marvelous cures have been accomplished in cases of consumption where hope had been given up. There are many people who would pay any price to be delivered from the great white plague. Quito seems to be a cure. The days and nights are of twelve hours' duration the year round. The difference between sun and shade is 10 degrees. This difference is felt at once by moving from sun to shade or *vice versa.* A journey of four hours from the city will place the traveler in the region of eternal frost, or in the space of half a day he can descend to the deep and sultry valleys which separate the mighty chains of the Andes. This variation of temperature, depending upon elevation and occurring between narrow limits, furnishes a daily and diversified supply of vegetable food, from the banana, pineapple, orange, and plantain, to wheat, corn, potatoes, cabbages, salads, apples, pears, grapes, and strawberries. Hens lay so persistently that medicine has to be given to them to save their lives. As the climate is cool and the houses unheated, daily and frequent exercise on foot or on horseback is absolutely necessary. On leaving the city it is difficult to avoid the sun, as trees are scarce; but sunstroke is unknown. Mosquitoes, snakes, scorpions, tarantulas, and rats are unheard of. There are no bugs or beetles.

The flora of Quito is beautiful and inexhaustible. Roses bloom all the year round; wild flowers cover the sides of courtyards and ruins; tulips, orchids, pinks, and lilies bloom winter and summer, and geraniums run riot over walls and roofs.

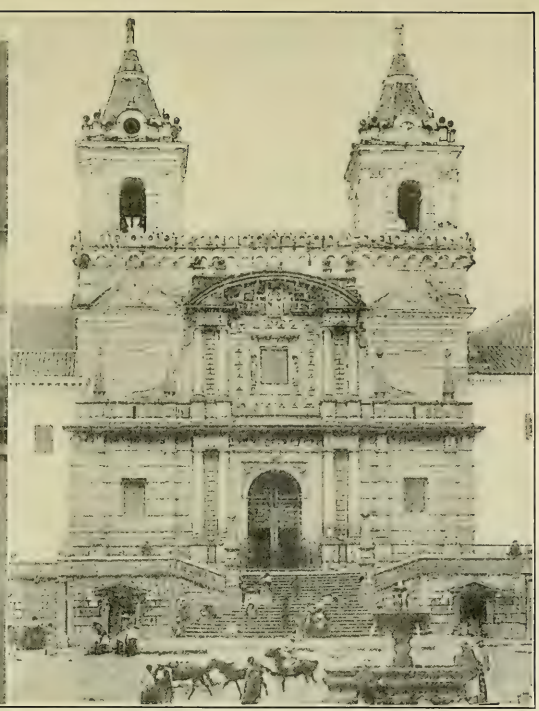
COMMERCIAL PROSPECTS

Ecuador is a sound-money country and has never issued paper money. As the Ecuadorians have demonstrated in the past their good sense in this matter, the actual currency, which is on a gold basis, is unlikely to be disturbed in the future.

Ecuador has no foreign debt. The only foreign debt incurred has been paid off. This was the money borrowed during the struggle for independence. The only obligation of the government at present is the interest on the bonds issued for the construction of the Guayaquil and Quito Railroad. Development always follows the railroad.

Ecuador is the principal producer of cocoa and ivory nuts in the world. On the coast, coffee, rubber, bananas, sugarcane, rice, cotton, and tobacco grow luxuriantly. Upon the plateaux of the high districts are produced wheat, corn, oats, beans, potatoes, and all the principal

Street Scene in Quito



The San Francisco Cathedral, Quito

From stereograph, copyright 1906, by Underwood & Underwood, New York

Llamas and Their Driver, a Native Indian of Inca Descent

These tough little beasts are akin to the Arabian camel and are used commonly for beasts of burden on rough mountain roads in the Andes. They can carry 100 pounds apiece and travel nearly all day, picking up their food as they go along in the form of wayside grass, twigs, etc.

cereals of the Temperate Zone. This section also supplies cattle, horses, sheep, and pigs. There is abundant pasture all the year. It is an agricultural country.

The establishment of industries is welcomed. The rivers on the coast and the streams in the mountains furnish ample and cheap water power. Some of the industries which would give results are banana planting on the coast, where land and labor are cheap, the crop finding a ready market; lard-refining, as immense quantities are imported by way of Panama and Cape Horn to supply Ecuador, Peru, and Chile; cotton and woolen mills for the same markets; cement works to supply public construction and railroad building; furniture factories, china and glass works, distilleries, and canning and preserving factories—all these industries would find the necessary elements, raw material of the best quality, and cheap labor. For cement the country provides all the materials; also for china and glassware; for shoes, fine leather and hides; for furniture, a great variety of useful and precious woods. There is enough land on the coast available to supply the banana market of the world. The fisheries around the Galapagos Islands, which belong to Ecuador, are well stocked with turtle and codfish. The climate is mild, the sea is calm, and there is abundant salt. There are extensive coal deposits in the province of Azuay and gold and silver in the provinces of Loja, El Oro, and Esmeráldas. Ecuador is a rich country awaiting development, where there are opportunities for the capital and spirit of foreigners.

The Republic has good currency, cheap labor, plenty of water power, abundant raw material of superior quality, many rivers on the coast for transportation, and a railroad into the interior. But the doors of trade cannot be opened unless the merchants and capitalists of this country heed the invitation and enter the markets, in which they are assured a preferred place, and lay the lines of mutual trade relations that will redound to the advantage of the countries concerned.

This initiative must be found here, and it is certain that commercial interests of this country and the American investors will put the sickle into the field sowed by our great Secretary of State, the Hon. Elihu Root, and already ripening.

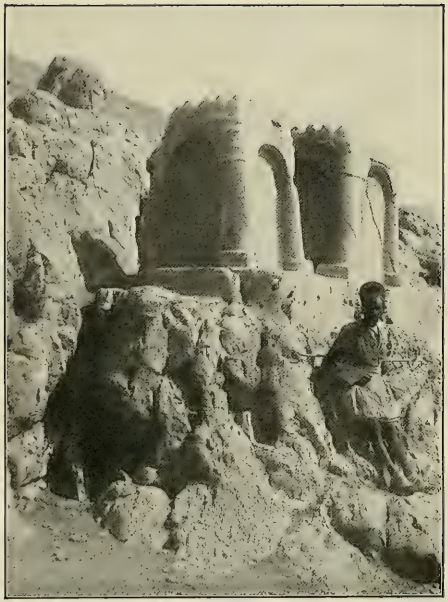
Germany, Great Britain, and France are in the field, Great Britain having a larger trade balance to her credit than this country enjoys. The success of the European trader is due to his closer study of the needs of the people. They have their particular predilections in trade, and these can only be ascertained by a careful study of their lives and wants.

America has the world as her market, but it is in the line of self-interest that she should stimulate, encourage, and develop the South American trade.

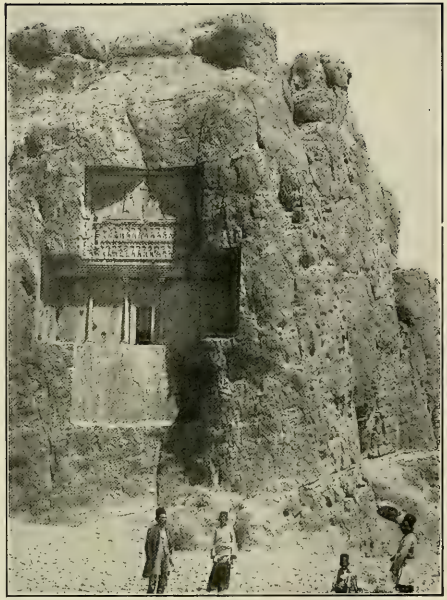
PERSIA—PAST AND PRESENT*

THE recent death of the Shah of Persia and plans in that country for a constitutional assembly lend special interest to this handsome volume. The author, who is professor of Indo-Iranian languages in Columbia University and a well-known writer on the Zoroastrian beliefs, describes some extensive journeys through the ancient kingdom. The chapter on the ruins of Persepolis, which was founded by Darius the Great in 500 B. C., and which flourished for many centuries thereafter, is particularly interesting. Through the courtesy of Messrs Macmillan Co., the publishers, we are enabled to republish

*Persia—Past and Present. A Book of Travel and Research. By A. V. Williams Jackson. With more than 200 illustrations and one map. Pp. 490. 6½ by 9 inches. New York: The Macmillan Co. 1906. $4.00 *net*.



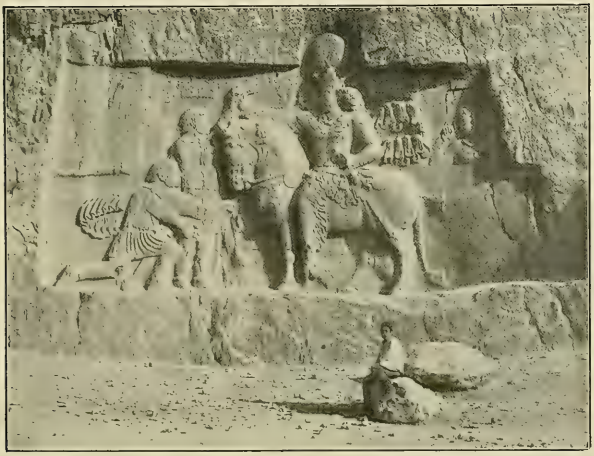
Rock Hewn Fire Altar, Persepolis



The Tomb of Xerxes, Carved in a Rock Cliff

This and the succeeding illustrations are from "Persia—Past and Present," by Prof. A. V. Williams Jackson, and are copyrighted, 1906, by the Macmillan Co.

Subject Nations Bringing Tribute to Xerxes



A Rock Panel Below the Tombs of Darius and Xerxes

Carved at least 700 years later. It represents the surrender of the Roman Emperor Valerian (260 A. D.) to the Persian King

The Domed Roofs of Kashan

A Typical Group of Mullahs and Seids

several views of this remarkable city. On page 92 is given an illustration of the portal to what is probably the tomb of Xerxes. There are four such tombs in a row carved out of a solid rock cliff. One has been identified as the tomb of Darius, and the others are probably those of Xerxes, Artaxerxes, and Darius II. The entrance to each is so high that from the ground ropes and ladders must be employed to reach it. Each tomb is a lofty chamber entirely carved out of rock, now empty except for numerous bats and birds. But even more wonderful are the vast masonry terrace on which were built the palaces of the kings and the triple wall surrounding it. Here Alexander the Great, according to tradition, held a great orgy, and then burned the palaces and the royal library, with all its manuscripts, in order that posterity might know nothing of its former grandeur. The Mohammedans, who came later, scoured the country for manuscripts. One governor issued an edict that every Zoroastrian should bring him about 14 pounds of Zoroastrian and Parsee books, in order that all these books might be burned, and he concluded his mandate with the order that any one who disobeyed should be put to death. No wonder the history of these people is shrouded in mystery.

The publishers are to be commended for the excellent map, an expense which few publishers are willing to incur. A valuable bibliography and index are also given.

AN ICE WRAPPED CONTINENT*

TO the south of Magellan Strait there is a supposed continent, twice the size of the United States, which is justly called the most mysterious land in the world. During the last few years five expeditions from as many nationalities have sought to unravel the wonders of this vast region, but only one expedition, the British South Polar expedition under command of Captain Robert F. Scott, R. N., has succeeded in getting near enough to do exploring work. This expedition was planned by the Royal Geographical Society of London and assisted financially by the Royal Society and by the British government. It sailed from London July 31, 1901, on *The Discovery*, which had been especially built for the work, and returned to England September 10, 1904. An unfortunate attack of scurvy during the first year, caused by tinned meats, and the fact that three relief ships were sent after it, unnecessarily it developed afterward, at first somewhat dampened the enthusiasm with which the discoveries of the expedition were received, but the scientific reports now appearing show that immense additions have been made to our knowledge of the "bottom of the globe."

Captain Scott was very wise as well as fortunate in his choice of base, which he established at the western end of the great ice barrier, under the shadow of two lofty snow-clad volcanoes, Mounts Terror and Erebus, which Ross had seen in state of violent eruption 60 years before. To the east stretched the unending plain of the ice barrier, while to the west towered a great range of mountains, with peaks 9,000 feet in height. The first year efforts were concentrated in exploring the ice barrier, and the second to discovering what lay behind the chain of mountains.

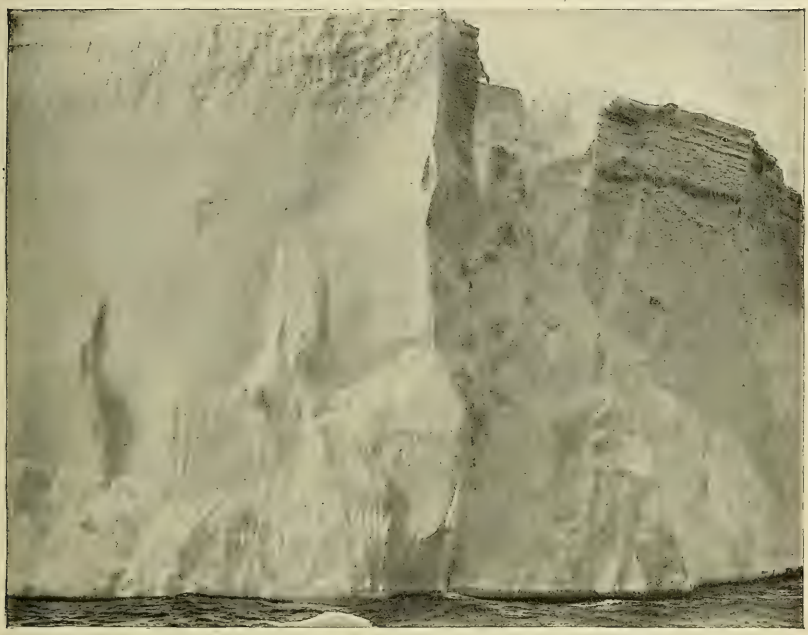
THE GREAT ICE BARRIER

"Perhaps of all the problems which lay before us in the south, we were most

*A review of "The Voyage of *The Discovery*," by Captain Robert F. Scott, with 260 full-page and smaller illustrations, by Dr E. A. Wilson and others, 14 colored plates, and 2 maps. 2 vols., 556 and 508 pages. New York: Imported by Charles Scribner's Sons. $10.00 *net*.

The Great Ice Barrier

Captain Scott sailed for 500 miles along this continuous cliff of ice, which rises from 10 to 280 feet above the sea. He also traveled 400 miles over it straight into the interior—from 78° to 82° 17′ south latitude—but even then did not reach or see its end. The barrier is afloat, but is apparently wearing away at the rate of about one-half mile a year. Captain Scott reports that it has receded 30 miles since Sir James Ross examined its front. This and succeeding illustrations are from "The Voyage of *The Discovery*," by Captain Robert F. Scott



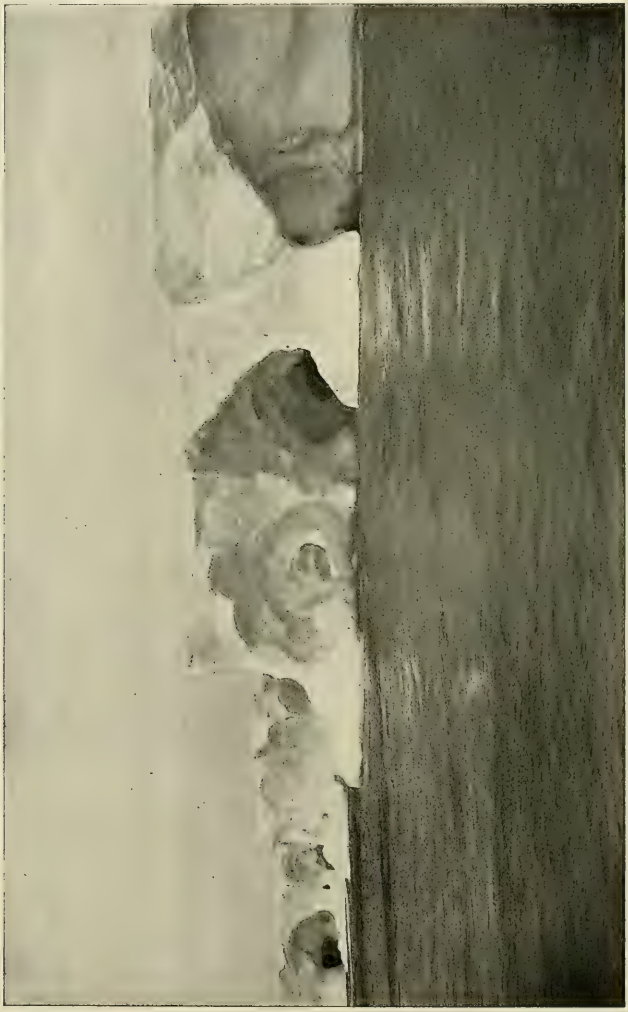
The Highest Ice Wall Seen (about 280 feet in height)

keenly interested in solving the mysteries of this great ice-mass. Sixty years before, Ross's triumphant voyage to the south had been abruptly terminated by a frowning cliff of ice, which he traced nearly 400 miles to the east; such a phenomenon was unique, and for sixty years it had been discussed and rediscussed, and many a theory had been built on the slender foundation of fact which alone the meager information concerning it could afford."

Before taking *The Discovery* to her permanent quarters, Captain Scott coasted along the entire front of this barrier, and determined that it extended from the volcanoes Erebus and Terror for nearly 500 miles to an ice-clad land on the west, which he discovered and named King Edward VII Land. When he afterward charted the track of the ship he found he had sailed from 20 to 30 miles farther south than Ross had done; in other words, that 20 to 30 miles of ice barrier had worn off since Ross had seen it.

At one point he halted the ship and moored her to the barrier for a day, while different members of the staff ascended in a captive balloon to 800 feet elevation. While lying alongside the ice wharf for 24 hours, the ship and wharf rose and fell together. The depth of water here was 315 fathoms.

Captain Scott makes the important observation that the surface current set into



Another Portion of the Ice Barrier, Showing How It Wastes Away

the barrier and under the ice for a certain time, then turned and set out again to sea. It would be very interesting to know how far "inland" this flux and reflux penetrates.

During the first spring and summer Captain Scott, Lieutenant Schackleton, and Dr Wilson advanced 400 miles due south across the barrier to 82° 17′ south latitude. When they halted they could see to at least 84°, but the barrier still stretched ahead, apparently unending. If the dogs had not failed the party, they would probably have succeeded in getting farther, but, as it is, they beat the record for the "Farthest South" by several degrees.

This ice barrier is probably thrust off of some great body of land enveloping the South Pole. While the barrier is wearing away in front, as proven by the fact of its retreat of 30 miles in 60 years, it is being constantly fed in the rear; in fact, its recession in front would be considerably more rapid if the loss was not balanced by additions in the rear.* How far off the source is, is a mystery; and when we bear in mind the scarcity of precipitation in such southern latitudes, it is almost impossible to imagine where the supply is to be found.

The following year Lieutenant Royds led a party about 100 miles across the barrier to the east. Like Scott, he found it level everywhere.

It was on this journey also that a most interesting series of magnetic observations were taken by Bernacchi, who carried with him the Barrow dip circle, an especially delicate instrument. The great value of these observations lies in the fact that they were taken in positions which were free from all possible disturbances, either from casual iron or from land masses; the positions also run in a line which is almost directly away from the Magnetic Pole, and consequently the series is an invaluable aid to mapping out the magnetic conditions of the whole of this region.

Examining the Ice Barrier from a Balloon

THE MOST DESOLATE LAND IN THE WORLD

During the entire march of 400 miles southward over the ice barrier, Captain Scott had been flanked by a lofty mountain chain on the right at a distance of about 50 to 30 miles. The peaks he named after prominent Englishmen and supporters of the expedition, Mount Markham (15,000), Mount Longstaff (10,350), etc. At the end of the march he had tried to reach this land, but an immense chasm (page 102) barred his way. On his return to the ship, after an absence of 93 days, he found that Lieutenant Armitage had discovered a route across this chain of mountains, beyond which he reported a limitless ice-covered plateau at an elevation of 8,900 feet and flat as a table. Armitage, however, did

*Voyage of *The Discovery*, vol. 2, p. 421.

A View of the Ice Barrier, Looking Down from a Balloon

Dog Team on the March

The Chasm which Prevented Captain Scott from Reaching Land at the End of His 400-Mile March up the Ice Barrier

A View of Erebus from the South

The volcano is 13,120 feet high. It was constantly emitting smoke and glowed red at night, but no violent eruption occurred during the two years the expedition was in its neighborhood

Advancing Over the Great Inland Plateau

Nine thousand feet above the sea, discovered by Scott and Armitage. The most desolate land in the world, where the temperature in midsummer often falls to 40 degrees below zero

not attempt to advance across the plain. The following year Captain Scott and several companions ascended to this plateau by Armitage's route. Their dogs had all failed and the men were obliged to drag the heavy sledges. It was a heavy pull, as they had to climb 9,000 feet in 70 miles, up a rough glacier.

Captain Scott traveled to the westward about 200 miles across this plateau, which did not vary in altitude more than 60 or 70 feet. At one point he passed directly south of the Magnetic Pole.

"The error of our compass had passed from east to west and was nearly at its maximum of 180°; although I could not calculate it accurately at the time, I could get a good idea of its amount by observing the direction in which the sun reached its greatest altitude. The reader will see that from a magnetic point of view this was a very interesting region. We were directly south of the South Magnetic Pole and the north end of our compass needle was pointing toward the South (geographical) Pole.

"To show what a practical bearing this reversal of the compass had, I may remark that in directing Skelton on his homeward track to the eastward, I told him to steer due west by the compass card. It is only on this line or the similar one which joins the northern poles that such an order could be given, and we were not a little proud of being the first to experience this distinctly interesting physical condition in the Southern Hemisphere.

"There can be little doubt, I think, that the wind blows from the west to the east across this plateau throughout the winter, and often with great violence, as the high snow-waves show. What the temperature can be at that season is beyond guessing; but if the thermometer can fall to −40° in the height of the summer, one can imagine that the darker months produce a terrible extremity of cold.

"The interior of Victoria Land must be considered the most desolate region in the world. There is none other that is at once so barren, so deserted, so piercingly cold, so wind-swept, or so fearsomely monotonous.

"When the reader considers its geographical situation, its great elevation, and the conditions to which we were subjected while traveling across it, he will, I think, agree that there can be no place on earth that is less attractive.

"This great ice-sheet is unique; it has no parallel in the world, and its discovery must be looked upon as a notable geographic fact."

ICE-FLOWERS

In his diary, Captain Scott gives the following description of the only flowers they saw:

"*March 30 (Easter Sunday).*—Like yesterday, a fine day, with a light northerly breeze. This is a season of flowers, and behold! they have sprung up about us as by magic—very beautiful ice-flowers, waxen white in the shadow, but radiant with prismatic colors, where the sun rays light on their delicate petals. It was a phenomenon to be expected in the newly frozen sea, but it is curious that they should come to their greatest perfection on this particular day. The ice is about five inches thick and free from snow; consequently the ice-flowers stand up clear-cut and perfect in form. In some places they occur thickly, with broad, delicate, feathery leaves; in others the dark, clear ice surface is visible, with only an occasional plant on it; in others, again, the plants assume a spiky appearance, being formed of innumerable small spicules.

"The more nearly one examines these beautiful formations, the more wonderful they appear, as it is only by close inspection that the mathematical precision of the delicate tracery can be observed. It is now established that on the freezing of salt water much of the brine is mechanically excluded. Sea-ice is much less salt than the sea itself, and what salt remains is supposed only to be entangled in the frozen water. The amount of salt excluded seems to depend on the rate at which the ice is formed, and while some is

excluded below the ice-surface, some is also pushed out above, and it is this that forms the ice-flowers. The subject is very fascinating, and we have already started to measure the salinity of ice taken from different depths and formed under various conditions; the ice-flowers themselves do not seem to constitute a saturated solution of brine, and why they should differ in form in various places seems beyond explanation."

THE EMPEROR PENGUIN

"We had felt that this penguin was the truest type of our region. All other birds fled north when the severity of winter descended upon us; the Emperor was alone prepared to face the extremest rigors of our climate; and we gathered no small satisfaction from being the first to throw light on the habits of a creature that so far surpasses in hardiness all others of the feathered tribe.*

"Not many birds undertake to lay their eggs in the darkness of a polar winter, nor do many birds appear to think that sea-ice is the most attractive ground to 'sit' on. And when, in addition to this, we find the Emperor penguin hatching out its chicks in the coldest month of the whole Antarctic year, when the mean temperature for the month is 18° below zero, Fahrenheit, and the minimum may fall to –68°, I think we may rightly consider the bird to be eccentric.

"The Emperor penguin stands nearly four feet high, and weighs upward of 80 to 90 pounds. He is an exceedingly handsome bird, with a rich black head, a bluish-gray back and wings, a lemon-yellow breast, with a satin-like gloss on the feathers, and a brilliant patch of orange on the neck and lower bill. His movements are slow and stately, and the dignity of his appearance is much increased by the upright carriage of his head and bill. When a group of these birds is met with in the middle of the desert ice, where all around is gray and cold and white and silent, the richness of their coloring strikes one very forcibly. Their voice is loud and trumpet-like, and rings out in the pack-ice with a note of defiance that makes one feel that man is the real intruder. They have no fear, but an abundance of inquisitiveness, and a party such as I have mentioned will walk up to one with dignity, and stand in a ring all round, with an occasional remark from one to the other, discussing, no doubt, the nature of this new and upright neighbor.

"The method employed by the Emperor penguin for carrying the egg and chick upon his feet is shared also by the King penguin of the sub-Antarctic area, as we saw in our visit to their rookeries in the Macquarie Islands. The King penguin we saw as he sat in mud and puddles, with his single egg upon his feet, and now we saw the Emperor penguin doing precisely the same thing with his single chicken to keep it off the ice; and we are agreed that the term 'pouch,' which has been used in this connection, is one which not only does not describe the matter, but is anatomically wrong and misleading. The single egg, or the chick, sits resting on the dorsum of the foot, wedged in between the legs and the lower abdomen, and over it falls a fold of heavily feathered skin, which is very loose, and can completely cover up and hide the egg or chick from view. When the chick is hungry or inquisitve, it pokes out from under the maternal (or paternal) lappet a piebald downy head of black and white, emitting its shrill and persistent pipe until the mother (or the father) fills it up.

"The feeding is managed as with cormorants and many other birds, the little one finding regurgitated food when it thrusts its head inside the parent's mouth.

"I think the chickens hate their parents, and when one watches the proceedings in a rookery it strikes one as not surprising. In the first place, there is about one chick to ten or twelve adults, and each adult has an overpowering desire to 'sit'

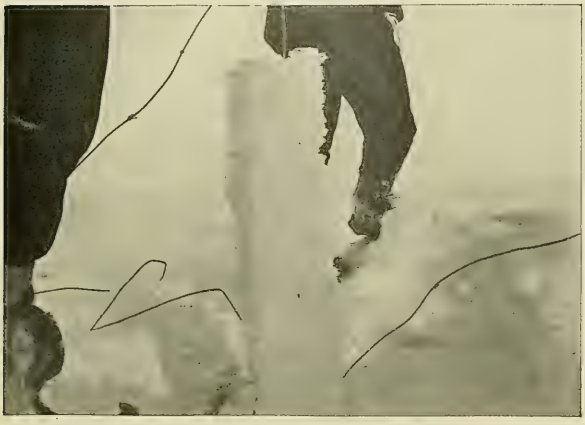
*This description of this remarkable bird is from the chapter on "Antarctic Fauna," by Edmund A. Wilson. Voyage of *The Discovery*, vol. 2, p. 469.

A Pressure Ridge Along the Coast

A Wandering Albatross Caught on the Voyage South

Endeavoring to Free the Ship by Blowing Up the Ice

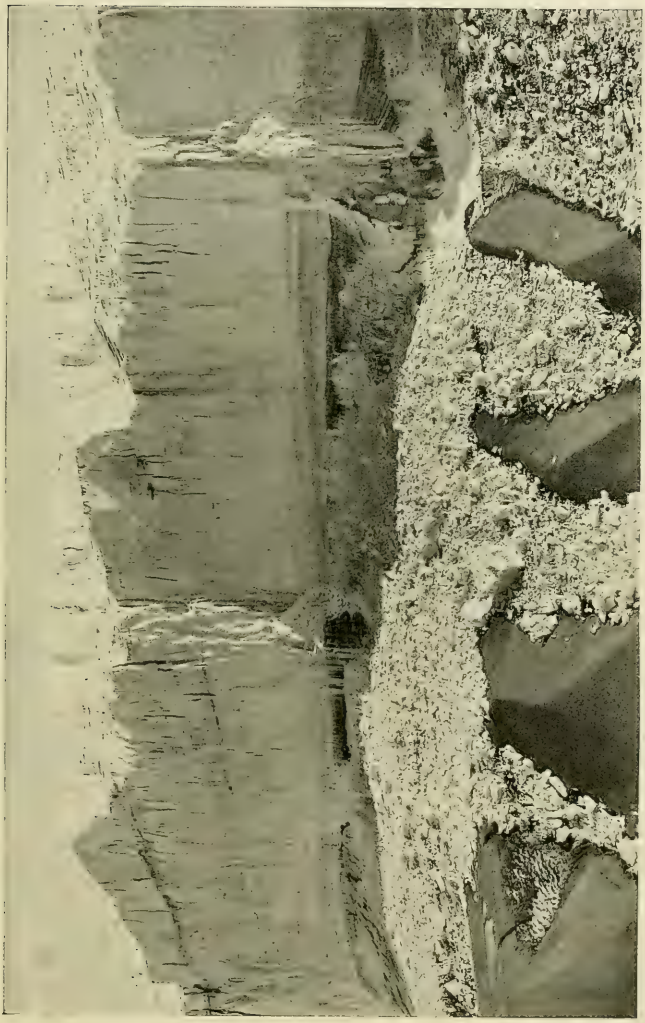
The attempt was unsuccessful



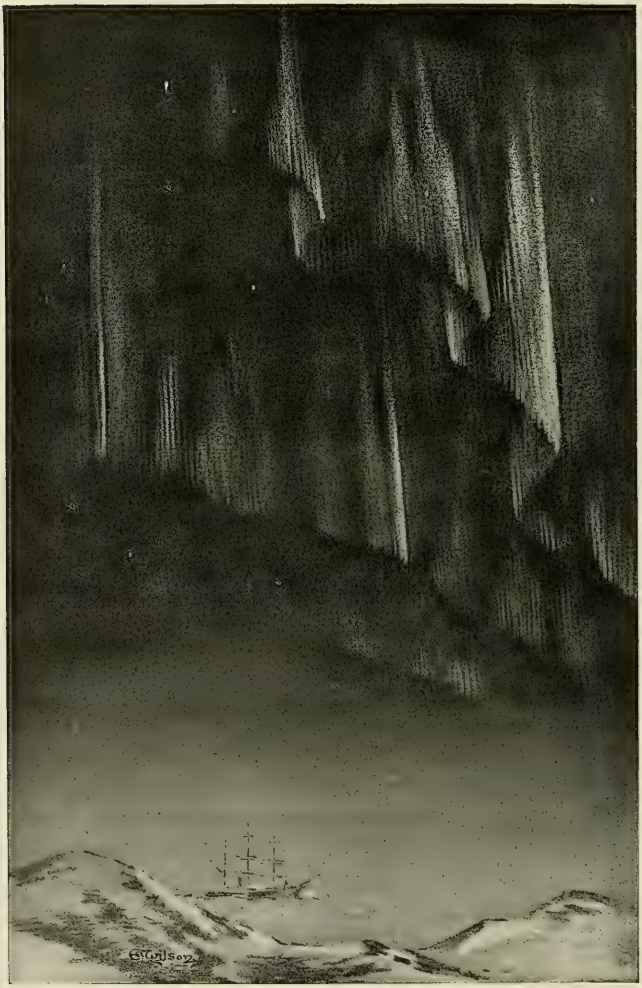
Ice Formed on Submerged Rope

The Hunter Waiting for a Seal to Come Up to Breathe

Ice Flowers. See page 105



The South Side of a Glacier



The Aurora Australis

on something. Both males and females want to nurse, and the result is that when a chicken finds himself alone there is a rush on the part of a dozen unemployed to seize him. Naturally, he runs away, and dodges here and there till a six-stone Emperor falls on him, and then begins a regular football 'scrimmage,' in which each tries to hustle the other off, and the end is too often disastrous to the chick. Sometimes he falls into a crack in the ice, and stays there to be frozen while the parents squabble at the top; sometimes, rather than be nursed, I have seen him crawl in under an ice-ledge and remain there, where the old ones could not reach him. I think it is not an exaggeration to say that of the 77 per cent that die, no less than half are killed by kindness."

SOME INTERESTING OBSERVATIONS

The power of the midnight sun in these latitudes is illustrated by the fact that when several members of a party were caught on a ice-floe for several hours without matches, Dr Wilson was able to produce a light for their pipes from a small pocket magnifying glass. During the summer the biologist of the staff succeeded in growing a crop of mustard and cress. He raised some on flannel and with chemicals, but the best result was obtained from Antarctic soil, "which is evidently most productive."

No vegetation of any kind was seen anywhere, but, on the other hand, they found an abundance of animal life, so that no party wintering in the Antarctic regions will have difficulty in providing themselves with fresh food.

On their ascent to the inland plateau they "passed two more carcasses of Weddell seals; the last was at the greatest altitude we have yet found one, nearly 5,000 feet above the sea; it grows more than ever wonderful how these creatures can have got so far from the sea. We never satisfactorily explained this matter. The seal seems to crawl to the shore or the ice to die, possibly from its instinctive dread of its marine enemies; but unless we had actually found these remains, it would have been past believing that a dying seal could have transported itself over fifty miles of rough steep glacier surface."

The dogs which had been brought from Siberia had the unpleasant experience of molting in winter, which was the Arctic summer, but their fur soon came out again.

The members of the party kept up their good spirits by outdoor games. One of the most spirited contests was a game of hockey April 7 by "The Married and Engaged *vs.* The Single," the match being played in a temperature of –40°.

AMERICAN EXPLORERS OVERLOOKED

Every one who reads Captain Scott's narrative as given in "The Voyage of *The Discovery*" must admire the strong and hearty personality of the leader. He is full of energy, and not only did the hardest work himself, but was able to get others to follow him willingly and cheerfully. His lieutenants and men likewise command our respect for their courage, fidelity, and faithful work.

It is unfortunate, however, that in his résumé of what has been done in the far south by previous explorers he completely overlooks the two Americans who discovered the Antarctic Continent—Palmer, who first saw the western half of the continent, now called West Antarctica, and Admiral Charles Wilkes, who first sighted and defined the eastern half of the continent, known as Wilkes' Land.

To quote Major General A. W. Greely, U. S. Army:

"Captain Scott is happier as an explorer than as an historian. From his narrative and charts is absent the name of the American who discovered the Antarctic Continent, Captain N. B. Palmer. Further, not only does Scott omit mention of Palmer and erase his name from the Antarctic map, but he gives the credit for the first discovery of land in the Antarctic regions to the distinguished Russian navigator, Bellinghausen.

"The discovery in the summer of 1820-1821 of Palmer Land, from the summit of

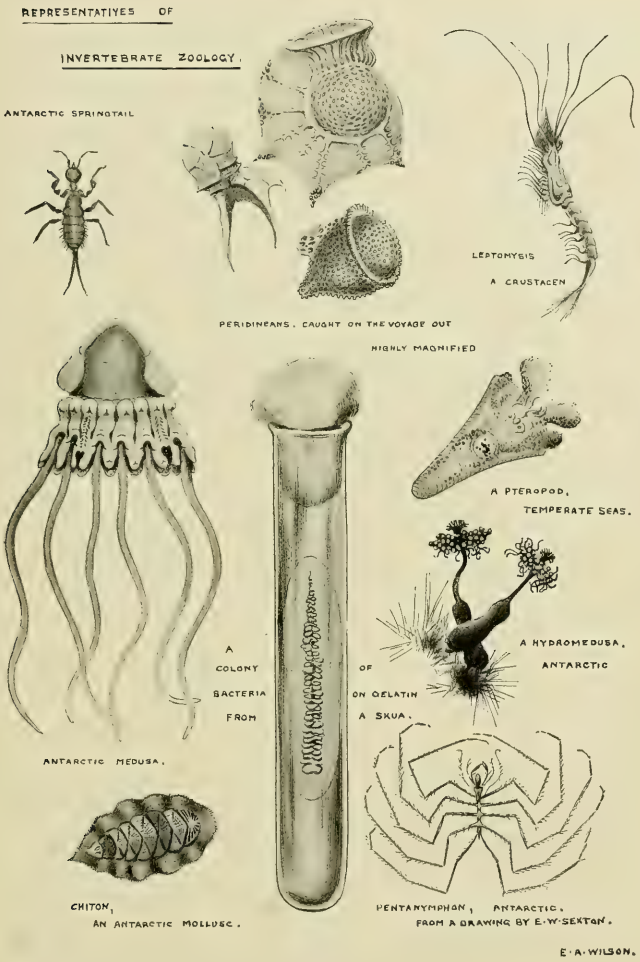
Outline Map of South Polar Regions

Deception Island, South Shetlands, is described in Fanning's Voyages, p. 435. Captain N. B. Palmer, in the sloop *Hero*, visited this land, and on his return passage fell in with Bellinghausen, whom Palmer informed of the mountainous land to the south."

But more remarkable was the voyage of Admiral Charles Wilkes, in 1840. To quote Edwin S. Balch, author of "Antarctica:"*

*NATIONAL GEOGRAPHIC MAGAZINE, 1903, p. 218.

"With unsuitable, improperly equipped ships, amid icebergs, gales, snowstorms, and fogs, Wilkes followed an unknown coast line for over 1,500 miles, a distance exceeding in length the Ural Mountains. It is the long distance which Wilkes traversed which makes the results of his cruise so important, for he did not merely sight the coast in one or two places, but he hugged it for such a distance as to make sure that the land was continental in dimensions. The expedition noticed appearances of land on January 13; it



Representatives of Invertebrate Zoölogy

A Rookery of Emperor Penguins

For the remarkable breeding habits of this eccentric bird see page 106

Emperor Penguin and Chick

sighted land almost surely on January 16, from 157° 46′ east longitude, and again more positively on January 19, from 154° 30′ east longitude, 66° 20′ south latitude. On January 30 the size of the land was sufficiently ascertained to receive the name 'Antarctic Continent,' and this discovery of Wilkes is the most important discovery yet made in the Antarctic."

Impartial geographers in due time recognized the importance of Wilkes' discovery, and in recognition of his work affixed the name Wilkes Land to the portion of the Antarctic Continent along which he coasted.

The homeward track of *The Discovery* disproved the existence of merely a small part of Wilkes Land, namely, Eld Peak and Ringold's Knoll, to the east of Adelie, but Captain Scott adds that "whilst it is certain that we must reject Wilkes Land to the eastward of Adelie Land, Wilkes' soundings still remain as a guide to the limit of the continental plateau in this region. Our own uniform soundings of 250 fathoms, together with his, show that there is considerable extent of shallow sea, limited more or less by the track of the Wilkes' ships, approximately along the Antarctic Circle."

The German South Polar expedition confirmed the opposite end of Wilkes Land in 1902.

G. H. G.

THE BATHING AND BURNING GHATS AT BENARES

By Eliza R. Scidmore

Foreign Secretary of the National Geographic Society

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THE greatest human spectacle in India, the most amazing and complete exhibition of blind religious zeal and superstition in all heathendom, is the sunrise gathering of Ganges worshipers along the river bank at Benares. It is such an incredible thing that the winter tourist cannot realize that he sees the spectacle when the fewest Hindus are taking part; and it is impossible to conceive how the thirty and fifty thousand bathers of a winter's morning, are doubled and trebled on the occasions of the great summer festivals, and the imposing river front of the sacred city is one solid mass-meeting three miles long. The half cannot be told one, and roaming up and down the river front two and three mornings in succession leaves one as much amazed and impressed as on a first morning. One has heart-sinking doubts of the Christian missionaries ever being able to make headway with such a people, against such bigoted zealots. But, as Gautama Buddha once won them from Hinduism at this very place and held them to his purer faith for generations, they can be converted again.

THE SACRED CITY

Benares, as a sacred city resting on Shiva's trident spear, has been the goal of Hindus for all of thirty centuries. The pious one seeks Benares in sickness and in health, in prosperity and in adversity, to beseech the gods, to implore their aid, to vow rewards to them and to fulfill those vows. The dream of his life is to retire to Benares in his old age, to die in sacred Kasi, to have his body cremated at the edge of "Mother Ganges" and the ashes committed to her flood. Every Hindu prince and noble and rich man has a house at Benares, and it is the acknowledged center of learning and culture of the Hindu world. Literature and astronomy have flourished there for ages, and colleges of western learning instruct in the exact sciences and even sanitary science; yet the old observances prevail and the Hindu changes his spots no more than the leopard—for a little matter of memorizing the words of a few dozen English text books. He may lead a life outwardly conforming to European conventions and customs, but, when ailing, he seeks Benares, to be cured by the touch and taste of Ganges water; and dying, he begs to be buried within sight of the spires and shrines that line the ghats.

Benares stretches for three miles along the left, or west, bank of the Ganges, that there turns northward, and all the city's extent is sacred ground. Who dies there on the left bank is sure of exalted estate hereafter; while the right bank is desolate and accursed, and whoever dies on that stretch of Ganges shore becomes a donkey in the next incarnation, without hope forever. One bank of the muddy stream is steep and high, crowded with palaces, temples, and hanging gardens, with the broad, magnificent flights of steps, called ghats, sweeping down between them to the river's edge. The opposite shore is low and sandy—a flat land, useful only for sunrise effects. The Maharajah of Benares has a white marble palace on the right bank, far up stream, its terraces and marble-screened balconies commanding a noble view of the whole stately city front; but the prejudice is not allayed. No one dies in this Ramnagar palace, nor in the village behind it, if mortal effort can prevent. The dying are bundled into boats in

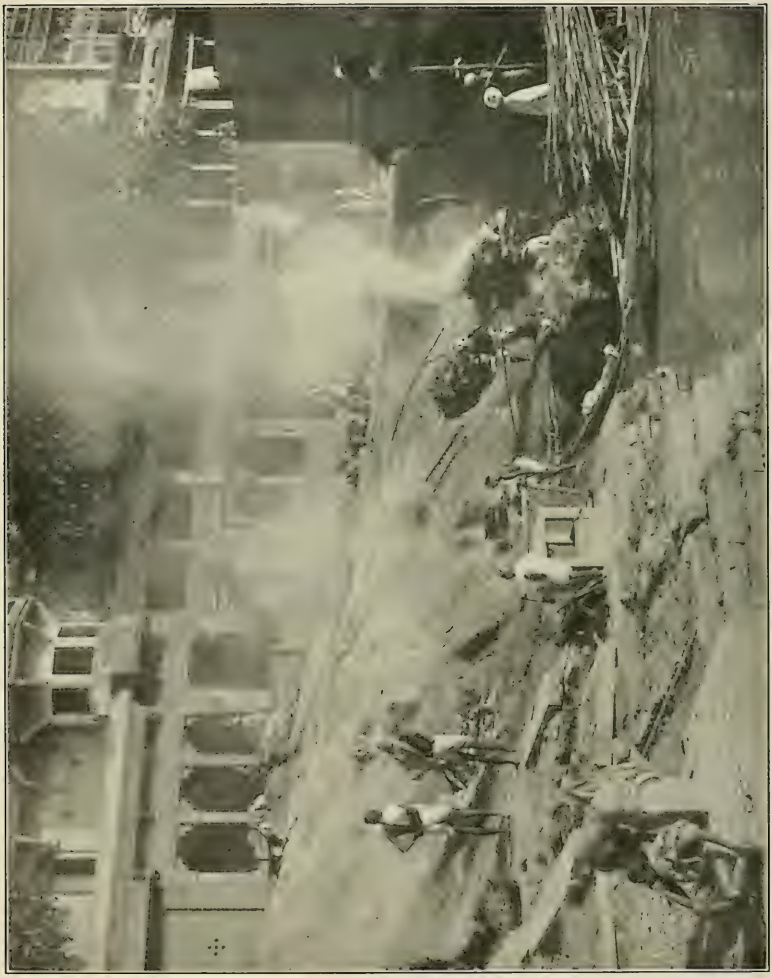
Morning Strollers on the River Bank, Benares

panic haste, for it is as good to give the death rattle on Mother Ganges' breast as on the Benares shore.

The traveler coming up from Calcutta gets a bewildering and better view of the splendid city front as he crosses the high railway bridge across the Ganges—the fortified iron structure made real to every one in Mrs Flora Annie Steel's "Voices of the Night." Then the long fantastic line of the ghats is succeeded by three miles of suburbs, of dingy plaster and adobe walls and dusty tamarind trees, the commonplace railway station, and the vast spaces of the Cantonment, or European settlement. A British regiment is always quartered beside this hotbed of fanaticism, political conspiracy, and disaffection and all heathenish possibilities. The officers and the many officials of the civil service give Benares a considerable English community, that has its church and club, its tennis courts and polo ground.

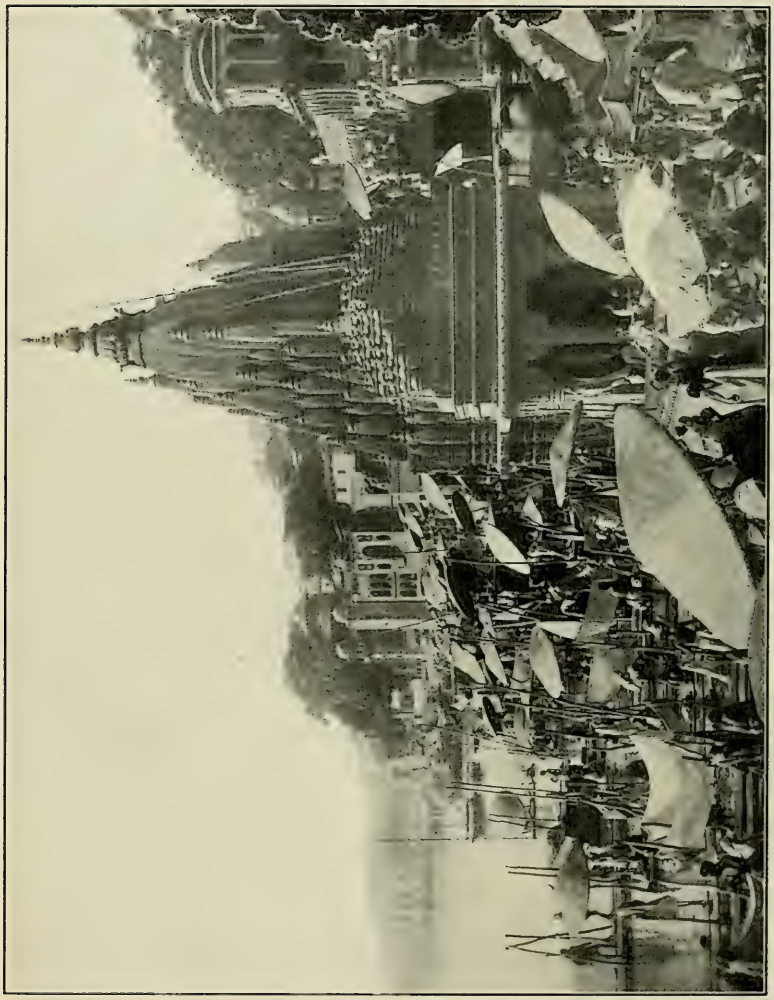
Sight-seeing begins at Benares before daybreak, and one drives through the two miles of uninteresting streets in the starlight and gray gloaming, across to the boats at the river bank. In midwinter, the "cold-weather" months of Indian travel, it is bitterly cold at that hour—hoar frost on the ground, blue and lilac frost haze in the air. One needs all the fur wraps and rugs he can get to drive down to the river, yet is glad for the shelter of a sun umbrella before noon.

Every one at that hour was hurrying in the one direction, and when we had raced down the great steps and the houseboat was poled off from the bank, all the river front was before us like a theater stage lighted by the rising sun striking full upon it. As the sun shone



The Burning Ghat at Benares

Cremation in Progress, and Domris Washing Human Ashes at Water's Edge



The Bathing Ghats Along the Ganges, Benares

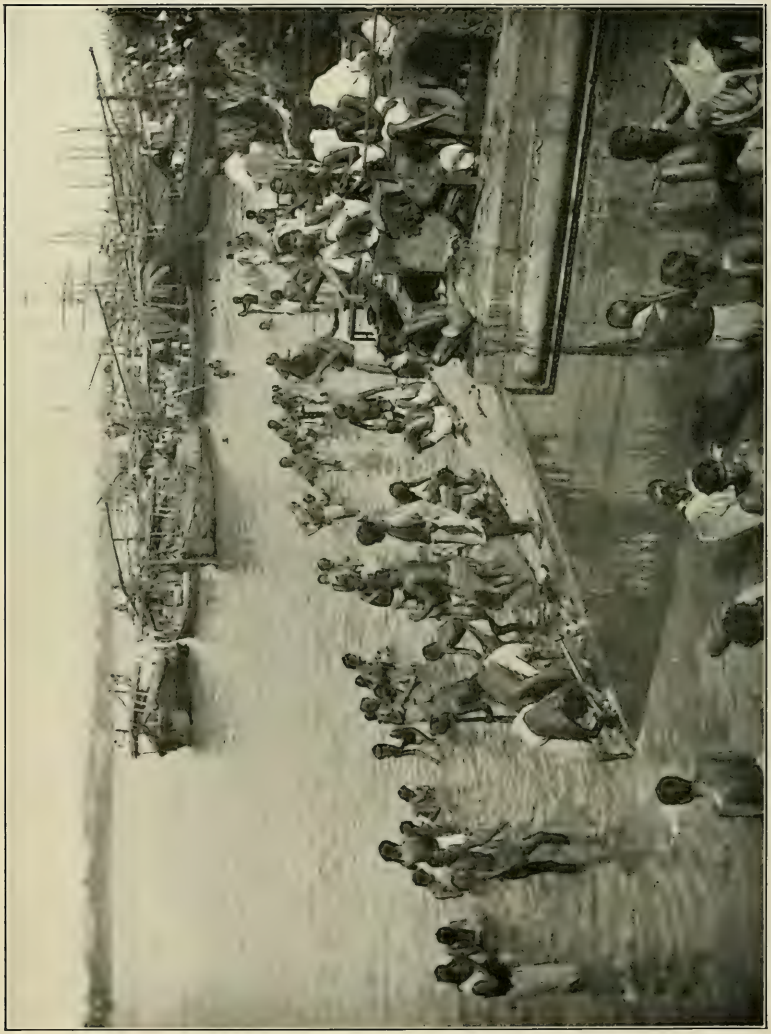
red, orange, and yellow through the thick frost haze, a great murmur of voices rose from the length of the ghats, the tens of thousands of fervent worshipers, standing on platforms built over the water and standing waist deep in the water, repeating in muttered chant the ancient Vedic hymn. They dipped themselves beneath the swirling mud flood; they lifted the water in jars and poured it over their heads; they lifted it in their hands and let it trickle through their fingers or run down their arms, and they dipped tufts of sacred grass in the water and sprinkled themselves; they pressed their nostrils, they twisted their fingers, and did all manner of motions as they chanted and muttered to themselves, each one rapt, intent, absorbed entirely in the long religious recitals. They paid no heed to us, nor to any happenings, for the Hindu ritual is so elaborate and exacting that if they should make a slip or omission, they would have to begin the long ritual all over again. For the priests and high-caste Brahmans, the daily prayers are of two hours' duration by the water side, and continue all day; but the ordinary man of Benares' bazars gets his morning ceremony done in far less time, wades back to shore and dry garments, spots and stripes himself with fresh caste marks for the day. He fills a brass jar with water and strolls along the ghats with the crowd, stops for a prayer or two, salaams to a cow or two, pours his water offering over some greasy black image, and his religious work is done.

There is no evidence at the ghats that Hinduism is dying out, but the census tables give one gratifying data. Not every believer goes to the Ganges each morning, by any means. Tens and tens of thousands must shirk their religious duties entirely; for, as the city has a fixed population of 222,400 and a floating population of ten to thirty thousand, it is only an eighth or tenth of them all that hail the sun across Mother Ganges. There are eighty thousand priests fattening in Benares temples, yet they are not all there at the river's brink either. All who go are in evidence, with the limelight of the rising sun full in their faces, save the few high-caste and noble women, who arrive before daylight and are rowed out in curtained boats to bathe and pray unseen in mid-stream. It must require physical courage as well as religious zeal to breast that cold, muddy current on a frosty morning; and, as the majority of these people have only a double cotton sheet for promenade toilet, one shivers sympathetically and wonders at the death rate from pneumonia.

The sun transforms the scene when it conquers the haze and throws clear yellow beams upon the solid and fantastic buildings and the white-robed company. The air mellows, and one basks in the sun thankfully, as do the beggars and fakirs, who shake off their wrappings of mat and sacking, and creep like numb flies to the side of sunny walls. They sit there until some ostentatious Hindu comes along doling out rice to the poor as a means of acquiring merit and favor with the gods—and to be seen of men. These ascetics, grotesque in their powdering of ashes and their rags, touch the sense of humor more than anything else and give one relief in the long-drawn panorama of heathen blindness.

THE WOMAN'S GHAT

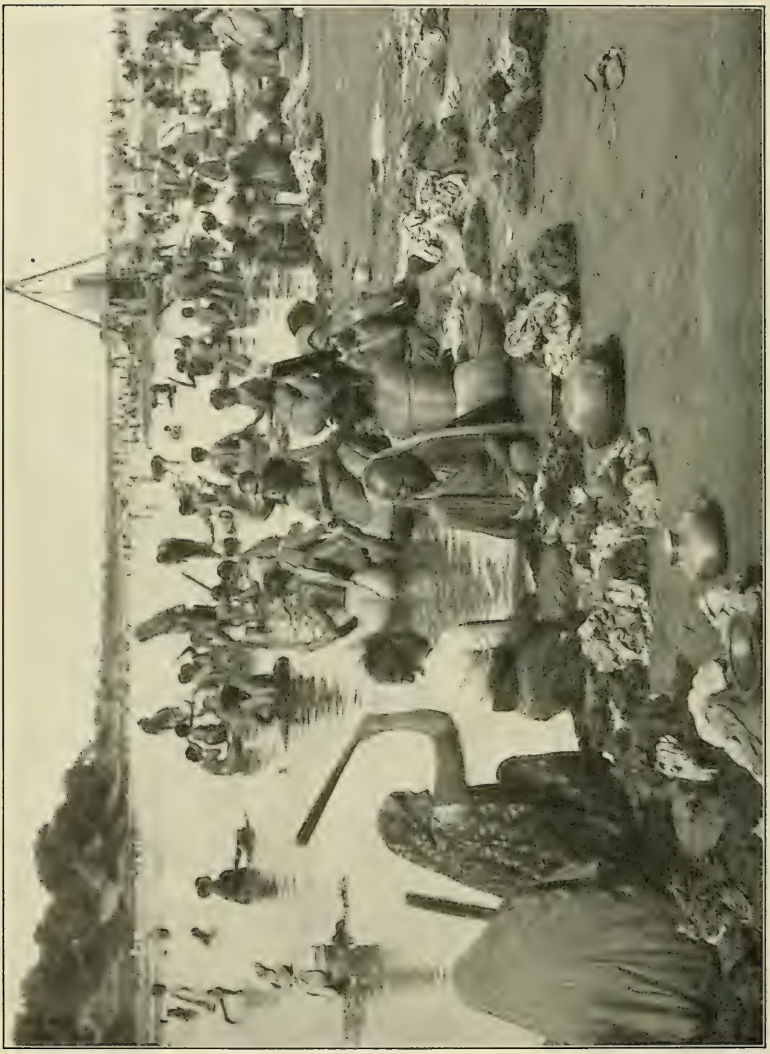
The boats are rowed along, close inshore, barely avoiding the most devout ones, who wade farthest out, and all the way there is the same spectacle of religious zeal and spiritual exaltation. At the Woman's Ghat every woman carries a brass lota, or water jar, or a still larger and heavier jar of red pottery, and the unending procession of gracefully-draped figures going up and down the broad ghat is an unending delight. Swathed head and all in their winding *saris,* they wade into the river and pray, one is sure, to every Hindu deity which the ten fingers represent to let them come into the world again in some human form less ignoble than a woman's. They go back to shore and deftly envelop them-



A Bathing Ghat

From "Winter India," by Eliza R. Scidmore, copyright by the Century Co.

The Woman's Ghat at Benares



Dhobie Ghat—the Public Laundry

selves in fresh *saris* and drop the wet ones to the steps without once uncovering the face or exposing more than the feet and hands. They scour their brass lotas with Ganges mud, they wash their hair with sacred muck and fill the jars to take home at the very mouths of the city sewers. The devotees show no fastidious choice in dipping the water they drink. All is Ganges water and all is sacred, even when the surface is afloat with city refuse discharging from the drain pipes at their very elbows. At some sewer mouths the fanatics even seem to stand thickest and sip the sewerage most assiduously, praying to the gods meanwhile to protect them from plague and all diseases. The British government has furnished a model water supply and sanitary sewerage, but the Hindus prefer Ganges filth to municipal drinking fountains, and there is no way to make them do otherwise.

THE BURNING GHAT

The cremation ground is only a waste space of grimy sand and gravel between two stone terraces, a neglected bank gullied by rains, with pyres, building and half-consumed, scattered irregularly, and ghouls poking among the ashes for coins or jewels. More systematic ghouls carry pans of ashes to the water's edge and wash this pay dirt like any placer miner. Alongside this revolting sequel to yesterday's burnings, lie fresh bodies, wrapped in white sheets and garlands of marigolds. The bodies are dipped in the Ganges and laid in rows, with the sacred stream laving their feet and profane ghouls washing pay dirt from yesterday's pyres between and beside them, shaking grime and cinders over the hapless, flower-wreathed bundles.

This rude, open-air crematory is the monopoly of the *domri*, lowest caste of all peoples, who charge extravagantly for their services, for the wood, the oil, and the flame which lights the funeral torch for touching off the pyre. The earlier in the morning the burning occurs, the greater merit and certainty of paradise for the dead one; and the *domri's* charges run from extravagant sums for burning the rich and noble at sunrise, and decrease toward noon and afternoon, when the very poor and the jail criminals are hurriedly burned, or half-burned, for a few annas, and the rubbish and bones shoveled down the bank. Only the highest-caste Brahmin priests and the holy fakirs escape the torch. These exalted beings are supposed to be so holy in life that fire is not needed to purify them. The flower-garlanded fakirs are rowed out to mid-stream and committed to Mother Ganges to carry them down to the sea—if alligators do not first consume them.

As the sun mounts and the air grows golden and softly warm, and the people finish their orisons, the river bank hums and buzzes with the great social exchange. All Benares strolls along the ghats in mid-morning, as all Atlantic City troops to the boardwalk, all Nice to the Promenade des Anglais. Big, flat, palm-leaf umbrellas are tilted against the too warm sun, *saris* and garments are stretched out to dry, and the carrying of water for household use, the washing of pots and clothing and vegetables sets tongues wagging as at any village tank. Belated Brahmins keep on praying and performing their rites and gestures, while their next neighbor on the overhanging platform shampoos his head or brushes his teeth; and the "Sons of the Ganges," a band of robust Brahmins whose specialty is prayer for the repose of the dead, bellow the merits of their particular intercessions above all the din. Then the fakirs wail and shake their ash-smeared heads, hold their shriveled arms the more conspicuously in the ten-year poses of rigidity, and stretch themselves more ostentatiously on the beds of nails. Snake-charmers are there, dancers and jugglers, and everywhere among the noisy crowds the sacred cows push their way, nosing into grain sacks and rice bowls unhindered, and stately Brahmins, painted in geometrical devices of the

highest caste and piety, salaam abjectly to them—a mad world, a crazy crowd, surely.

The throng is densest, the buzz and the bellowing loudest, at the ghat below the cremation ground, for there are the sacred pools filled with Vishnu's perspiration, and where Devi dropped her earring—good reason for sanctity attaching to them, certainly. At this storm center of the holy land of the Ganges bank, the din and the hot sun are dizzying, and the mixture of Ganges water, old flower garlands, milk, butter, oil, sweetmeats, spices, and incense, cast into the tank all day and every day, smells to heaven. The odor is sickening, the sight of the garbage mess more so, and the lepers and hideous sick folk, who crawl up and down the slimy steps, are fit figures in this picture of heathenism triumphant and undisturbed. Hindu intelligence may be measured exactly when one considers that the priests of the river bank could easily check these suicidal celebrants who flock there to drink the putrid mire in hope of cures.

Perhaps it is well that Mrs Annie Besant has established her college at Benares to teach the Hindus their own religion, the purer faith of Vedic times, freed from all the idolatrous and crazy abominations of later days. Nothing could be as bad as the creed that now enslaves them. Poseurs and unbalanced Europeans, who come out to India loudly proclaiming their willingness to labor with Mrs Besant to save the Hindus after this novel plan, return to the world at the end of each cold-weather season. The discipline is strict, the ideals high, the regimen severe at Mrs Besant's college, and even Pierre Loti, after all his sentimentality over the Hindus, could not stand the severe and monkish life prescribed for him by the English prophetess, and returned to the flesh pots of the worldly folk.

The fantastic little Nepalese temple on the river bank is the one living remnant of Buddhism in Benares, where the Buddha preached and taught, and converted the people from Hinduism. It is a dark, dragon-eaved structure with flame-tipped gables, sadly reminding one of Burma and the further east; but the Buddhism obtaining there is far from the simple teachings of the Enlightened One, who lived in the Deep Park out Sarnath way.

Aurangzib's mosque, with its two slender, sky-piercing minarets, is easily the most conspicuous structure along the ghats, as the conqueror intended it should be, and is a galling sight to Hindu eyes. The few Moslems, who can manage to still live in Benares, frequent it every Friday, and the muezzin flings his shrill voice from the minaret as if thousands hung upon his summons; but Hinduism has submerged the faith of the Prophet, as it triumphed over Buddhism centuries before.

THE PUBLIC LAUNDRY

In every river city there are bathing ghats, where the people purify themselves and their garments without the accompaniment of prayer, and there are also ghats by the river bank, or tanks where *dhobees* swing and pound clothes and knead them on boards or stones. The *dhobee* ghats and grounds are always picturesque, and when one sees the energy with which they switch and club the garments entrusted to them, there is no wonder at the way a wardrobe melts away in Indian travel. The corrugated washboard, the clothes-boiler, the labor-saving soap and soda are unknown and their advantages undreamed of, or the Hindu brain would have evolved them thirty centuries ago, when cerebration was more vigorous and all customs were established. The *dhobee* man and his harder-working wife slam and squeeze and hammer now, as they did in the first ages after the loom was invented, and when they have spread their dunnage on dusty turf or handy thorn bush the result is all that could be expected by the wearers of fine linen.

HOW LONG WILL THE COAL RESERVES OF THE UNITED STATES LAST?*

By Marius R. Campbell

Of the United States Geological Survey

WITH the exception of food and clothing, nothing concerns us so much as fuel. On it we depend for heat and light to make ourselves comfortable, and for power by which to bring within our reach all that goes to make up the material part of our twentieth-century civilization. Today power is the mainspring of human activity; with it modern civilization will flourish—will expand and reach out to the ends of the earth to minister to our pleasures or to satisfy our ambitions; without it so-called civilization will cease to exist and humanity will revert to the condition of primitive man, with brute force as the only dependence for safety and existence.

If, therefore, power is the foundation of all of the material things we consider worth having, is it not well to stop our mad race for a moment and consider whence it comes and how much of the raw material is available for future use?

Without doubt, coal is the only fuel that today is worth considering, and, so far as we can see ahead, it will continue to be the fuel of the future—at least so long as it is within our reach or until other means of power production shall supplant it. Therefore any study of the fuel supply of the future must be based upon a thorough knowledge of coal, its mode of occurrence, amount from which future supplies can be drawn, and rate of consumption, past, present, and to come.

The importance of the subject is shown by the growing value of the coal-mining industry in this country. In the United States in 1905† coal to the amount of 384,598,643 short tons, having a value of $476,756,963, was mined. The value, compared with other mineral products in the same year, is shown by the following table:

TABLE SHOWING VALUES OF MINERAL PRODUCTS OF THE UNITED STATES FOR 1905

(1)	Coal	$476,756,963
(2)	Iron	382,450,000
(3)	Clay products	149,697,188
(4)	Copper	139,795,716
(5)	Oil and gas	125,720,254
(6)	Gold and silver	122,402,683

At the present time the United States is the largest factor in the world's production of coal, as shown by the diagram on page 130.

In the diagram given above the production of the three leading countries is that for the year 1905; of the other countries figures for that year are not available, and the blocks in the diagram represent the production during either the year 1904 or 1903.

THE GROWTH OF COAL

Coal is derived from vegetable material, either as accumulations in swamps from plants growing *in situ* or as wood that has been drifted into basins. In either case the accumulation of vegetable matter has been covered by earthy material washed into the swamp or basin and finally converted into coal. The former hypothesis is more generally accepted than the latter, and it seems to apply to most of the coal beds of this country.

The transformation from vegetable matter into the different grades of coals is a process not well understood, but it seems to consist of the breaking up of hydrocarbons and a partial slow distilla-

*An address to the National Geographic Society, January 22, 1907.

†All statistics of production given in this paper are taken from U. S. Geological Survey, Mineral Resources of the United States for 1905.

Diagram Showing the Output of the Principal Coal Producing Nations

tion under considerable pressure, but only ordinary temperature. Where the rocks are undisturbed, this is probably an exceedingly slow process, but where the rocks are upturned and broken, the products of distillation find a ready means of escape and the metamorphism may go on at an extremely rapid rate. Naturally the escaping gases are the lightest hydrocarbons, and the material remaining is the heavier, or fixed, carbon.

In a general way, time is an important factor in bringing about this change, and consequently the older carboniferous coals of the east are more highly altered than the younger coals of the west. They are generally converted into bituminous coals, or, in the case of the eastern fields of Pennsylvania and Rhode Island, the intense folding, together with the development of joints and slaty cleavage, has converted the coal into anthracite.

If the coal is cut by dikes or sheets of molten lava, as frequently has been the case, rapid alteration occurs and the coal is converted into coke or anthracite coal. Such cases occur only in fields in which there has been considerable volcanic activity. High-grade coals may be produced in this manner, but generally only a small area is affected, and consequently the results are not of great commercial importance.

The progressive change in composition is shown in the diagram on page 131, which represents the actual chemical composition, as shown by proximate analyses, from the poorest grade of Texas lignite to the best quality of Pennsylvania anthracite.

The increasing value is shown by the relative proportions of fixed carbon (fixed carbon is the carbon remaining after the volatile hydrocarbons have been driven off at a low heat) and the decreasing amount of volatile matter and moisture. In this case the fixed carbon varies from 19 per cent in the lignite to 88 per cent in the anthracite. The volatile matter varies inversely as the fixed carbon, being greatest in the lignite and least in the anthracite. The moisture also diminishes in quantity from the lignite to the anthracite, but the rate is not regular, since much of the moisture is due to the conditions of sampling rather than to the chemical composition of the coal. The ash is variable, depending largely upon the amount of earthy matter that was washed into the old swamp during the growth of the coal-forming plants. The presence of ash is an important factor in the commercial value of a coal, but theoretically it forms no inherent part of the coal and should not be considered.

In a general way, coals may be divided

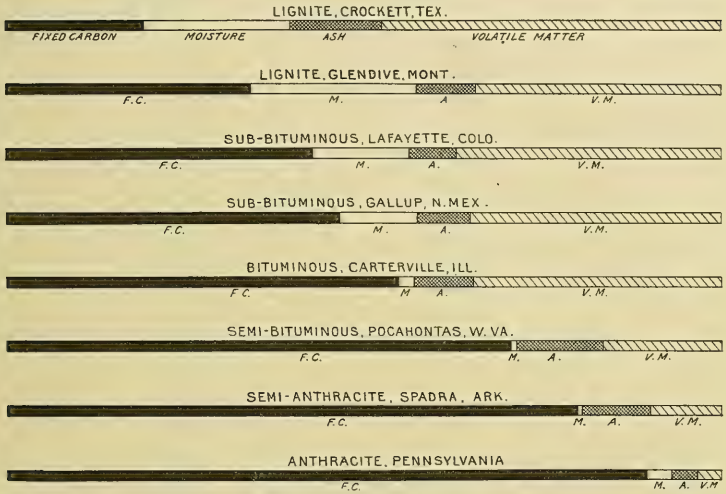


Diagram Showing the Progressive Change in Composition of Lignite, Bituminous and Anthracite

Note that all the moisture and volatile matter has been expelled in the anthracite

into three main classes—anthracite, bituminous, and lignite; but in the trade these main classes are broken up into several groups, which are represented in the following diagram:

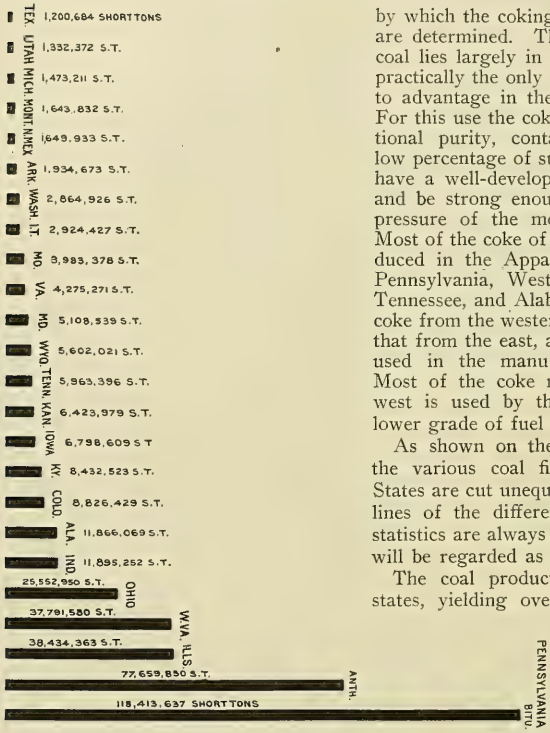
DIAGRAM SHOWING CLASS OF COAL

Coal..
- Anthracite.... (*a*) Anthracite. (*b*) Semi-anthracite.
- Bituminous... (*c*) Semi-bituminous. (*d*) Bituminous. (*e*) Sub-bituminous.
- Lignite..... (*f*) Lignite.

(*a*) Anthracite coal is too well known to need description. (*b*) Semi-anthracite is a low grade of anthracite. (*c*) Semi-bituminous is a high grade of bituminous, such as the George's Creek coal of Maryland, Pocahontas coal of Virginia and West Virginia, and the Carboniferous coal of Arkansas. (*d*) Bituminous is the common grade of coal found throughout the eastern coal fields and in limited areas in the west. (*e*) Sub-bituminous is applied to coals below the grade of bituminous, but above that of lignite. They are black and shining, but are light in weight and slack badly on exposure to the atmosphere. These coals are common in the western fields of Washington, eastern part of Montana, northern Wyoming, about Denver in Colorado, and in northwestern New Mexico. (*f*) Lignite is brown and woody, and occurs in North Dakota, South Dakota, Texas, southeastern Arkansas, Mississippi, and Alabama.

THE REASON WHY ONE COAL WILL COKE AND ANOTHER WILL NOT IS NOT UNDERSTOOD

The classes noted above include all of the different kinds of coal that are known, but certain peculiarities of coals within the bituminous class have led to



Coal Output of Principal Coal Producing States

distinctions which are of great importance; thus the property of coking, which is limited entirely to the bituminous class, has given to coals possessing this peculiarity a value far above those coals having similar composition, but which do not possess this characteristic. The reason why one coal will coke and another will not is not understood; apparently it does not depend upon chemical composition, but rather upon some physical property which no one has been able to define. A practical test is the only way by which the coking properties of a coal are determined. The value of a coking coal lies largely in the fact that coke is practically the only fuel that can be used to advantage in the production of iron. For this use the coke has to be of exceptional purity, containing an especially low percentage of sulphur. It also must have a well-developed cellular structure and be strong enough to withstand the pressure of the modern blast furnace. Most of the coke of this character is produced in the Appalachian coal field in Pennsylvania, West Virginia, Virginia, Tennessee, and Alabama. In general the coke from the western fields is inferior to that from the east, and little of it can be used in the manufacture of pig-iron. Most of the coke manufactured in the west is used by the smelters where a lower grade of fuel will suffice.

As shown on the map on page 135, the various coal fields of the United States are cut unequally by the boundary lines of the different states, but, since statistics are always given by states, they will be regarded as the units.

The coal production of the various states, yielding over one million short tons of coal in 1905, is shown in the accompanying diagram.

PENNSYLVANIA PRODUCES THE MOST COAL, BUT MONTANA HAS THE LARGEST COAL FIELDS

As commonly understood, Pennsylvania heads the list with a production which dwarfs that of all other states into insignificance. The other states of the east that occupy prominent positions are Illinois, West Virginia, Ohio, Indiana, and Alabama. Of the western states,

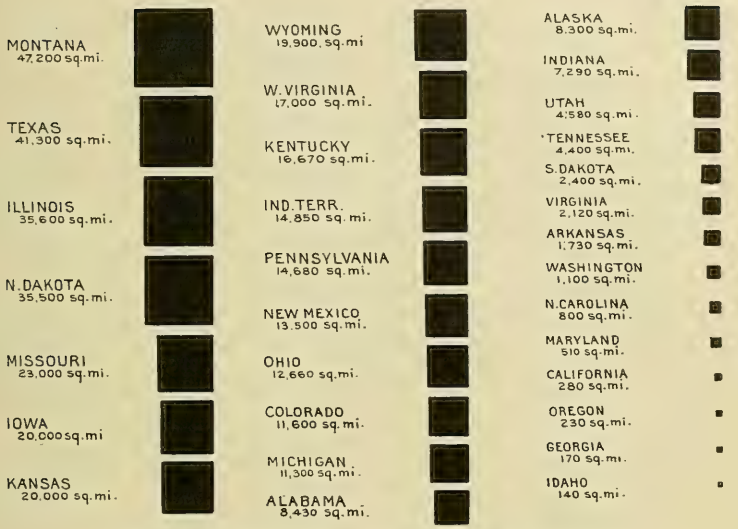


Diagram Showing the Coal Areas of the Various States

Colorado stands at the head, with a production of nearly 9,000,000 tons annually; Wyoming stands second, with a production of 5,600,000 tons; Washington third, with a production of 2,800,000 tons; New Mexico fourth, with 1,600,000 tons; Montana fifth, with 1,600,000 tons, and Utah sixth, with 1,300,000 tons.

The areas of the coal fields that lie within the various states differ greatly, even more than the production. The relative size of these areas is given in the following diagram:

To many readers it will be a surprise to learn that the coal fields of Montana are more extensive than those of any other state, and that Texas is a close second. In this connection it must be understood that each of these states includes an enormous territory, equal to two or three of the smaller eastern states. It is true, however, that most of the coal territory of these states is underlain by low-grade lignite, and hence the fields are not so important as their areas would seem to indicate. The same is true of North Dakota, which includes an extremely large area of coal territory, but unfortunately the fuel is wholly lignite and of comparatively little value.

The extent of some of the coal fields is largely hypothetical. This is particularly the case with Washington, where the present estimate is probably far below the real extent of the fields. It might be supposed that Washington had been explored thoroughly enough to determine approximately the extent of its coal fields, but the peculiar conditions which prevail on the west slope of the Cascade Range make it practically impossible to settle the question at the present time. The surface is deeply covered by glacial drift and vegetation, and it is only where the great streams rushing down off the mountain slopes have cut through this

drift that the coal beds are exposed. In this way they are known at many localities, and it is probable that they are present in the intermediate covered areas, but no one is willing to say so until more prospecting has been done. When that occurs it is probable that the recognized area of the coal fields of Washington will be greatly increased.

The known coal fields of Alaska seem to be comparatively small, having approximately the same area as the bituminous field of Alabama. Here again exploration may, and probably will, increase the area materially, especially that of the low-grade lignites of the Arctic slope.

The area given for the coal fields of Alabama includes only the bituminous coal of Carboniferous age in the northeast part of the state. In addition to this, as shown by the map on page 135, there is a wide band of lignite-bearing Tertiary rocks crossing the southern part of the state. These rocks are known to contain beds of lignite, but in the presence of high-grade bituminous coal the lignite has never been explored, and consequently the number of beds, their thickness and extent, are not known. It is possible that when the supply of better fuel is exhausted, or has fallen below the demand, the lignite field may be found to contain an important supply of fuel.

DISTRIBUTION OF COAL IN THE WEST

The eastern coal fields have been known and worked for so many years that most persons are fairly well acquainted with their extent, the character of the coal, and the number of workable beds. In the western states some of the coal fields are comparatively well known, but many have never been adequately explored, and consequently the information available regarding them is meager. So far as our present knowledge goes, the distribution of the various classes of coal in the western states is as follows:

Anthracite.—Only small areas of anthracite coal have been found in the western states and Alaska. Generally these are the direct result of volcanic activity, and hence are of limited geographical extent.

The largest field of anthracite coal in the western states is in Gunnison County, Colorado, in the Crested Butte region. Apparently the anthracite in this field is the result of immense intrusions of igneous rock, which have baked the coal and thus driven off its volatile matter. The same coal beds only a short distance away are either bituminous or subbituminous in character. One other occurrence of anthracite is known in Colorado, in the Yampa coal field, in the northern part of Routt County. In this locality the coal has been changed to anthracite by dikes and sheets of igneous rock, and the field is very limited in extent.

In New Mexico a small field of anthracite occurs near Cerrillos, on the Santa Fé Railroad. The field is small and the anthracite is due to the baking effect of an intrusive sheet of igneous rock.

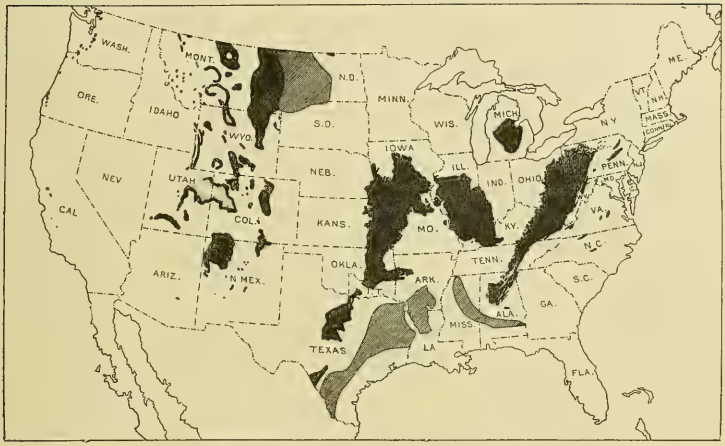
Utah claims a small field of anthracite coal in Iron County, near the southwestern corner of the state. It has not been developed and little is known of its extent or value.

In Washington a very small field of anthracite occurs in the vicinity of a large mass of igneous rock on Carbon River, southeast of Tacoma.

The largest anthracite field outside of Pennsylvania occurs near Controller Bay, in Alaska. In this field the change in the character of the coal is said to be not directly related to volcanic activity, but to be due to the intense folding to which the rocks have been subjected.

At the present time anthracite is mined in the west only in Gunnison County, Colorado, and near Cerrillos, New Mexico.

Coking Coal.—Good coking coal is scarce in the western fields. The principal source of supply is the Raton, or Trinidad, field, in southern Colorado and northern New Mexico. Seventy per cent of the coke produced in the western



Outline Map Showing Coal Areas of the United States

The black areas are anthracite and bituminous; the shaded areas are lignite

fields comes from this region. Some coke is also produced in Colorado, on the west side of the Front Range, at Durango and in the vicinity of Glenwood Springs. Other important centers of coke production are Castle Gate and Sunnyside, in Utah, and along Carbon River southeast of Tacoma, Washington. Coke is also made to a limited extent in Wyoming near the Black Hills and in southern central Montana. There are several other coals that will coke with difficulty, which may be developed in the future, but the present prospect is not particularly promising.

Bituminous, Steam, and Domestic Coal.—This class of fuel is much more abundant than either of the two preceding classes. In New Mexico the largest deposit of such coal is in the Raton field, in the north central part of the territory. Similar coal also occurs in the northern part of the great Durango-Gallup field, in the northwest corner of the territory, and in several small fields south of Santa Fé.

In Colorado good bituminous coal occurs in the fields just mentioned, at Trinidad and about Durango. It is also present in the small field south of Canyon City and in Gunnison County. As shown on the map, the latter field occupies the southeastern point of a large synclinal basin which extends as far west as Castle Gate, Utah. The coal outcrops on the south limb of this basin in the Book Cliffs west of Grand Junction and along the "Great Hogback" from Gunnison County northwestward through Glenwood Springs and Meeker. Throughout the whole line of outcrop around this basin the coals are of the bituminous class, although in places they belong to the lowest group of the class. Good bituminous coal also abounds in the Yampa field, in Routt County. Thus it will be seen that Colorado has a large supply of this class of coal.

Utah is also well supplied by the same basin and by its extension southward from Castle Gate along the Wasatch Plateau. There is also a small field at

Coalville, east of Salt Lake City, and a field of unknown extent in Iron County, occupying the Colob Plateau.

Wyoming has bituminous coals along the line of the Union Pacific Railroad at or near Hanna, Rawlins, Rock Springs, and Kemmerer, and also in small areas about the Black Hills. It is possible that other areas of bituminous coal exist in this state, but they are not well known.

Montana has considerable bituminous coal in the fields along the Northern Pacific Railroad west of Billings, about Great Falls, and in the Crazy Mountains, but by far the largest areas in the state carry coal of an inferior grade.

Washington has several bituminous coal fields along the western foothills of the Cascade Mountains and at least one local basin at Roslyn, on the eastern side.

Most of the coals of California are of low grade, but one bed has been developed in Stone Canyon, in the southeast corner of Monterey County, that is good bituminous coal. So far as known, this is the only coal of this class in the state.

Sub-bituminous Coal.—This class of coal is abundant in the western fields. Most of the coal in the south part of the Durango-Gallup basin is of this class. It is the only coal found in the Denver basin and in North and South Parks of Colorado. The great fields in the northeastern part of Wyoming, the Bighorn basin, and most of the fields in Uinta County contain sub-bituminous coal. All of eastern Montana is supposed to be underlain by it, as is also the big field in the north-central part of the state around the Bearpaw Mountains. A number of small fields lying west of Butte, Helena, and the main Front Range contain coal of this character, but generally they are of small extent and probably have little commercial value. In Washington this class of coal is abundant, but as a rule it occurs some distance west of the Cascade Mountains.

Lignite.—This class of fuel is found only in the fields of southern Alabama, Mississippi, Arkansas, and Texas on the Gulf slope and North and South Dakota at the north. It is mined commercially only in North Dakota and Texas.

THE COAL FIELDS BELONGING TO THE GOVERNMENT ARE MOSTLY LIGNITE

Up to the present time we have used our fuel without a question as to the possibility of its exhaustion, for if such a thought has entered the mind it has been dismissed with the optimistic remark that "the American people are ingenious and inventive, and when the coal becomes exhausted some other source of heating power will be discovered." Such assurance is delightful, but it will not suffice to keep us warm, nor to turn our mills and keep trains running when our coal supply is gone.

Of late, however, the more far-seeing people have been thinking deeply on this subject, especially since the recent order of the President withdrawing temporarily from coal entry 64,000,000 acres of coal land, and his recommendation to Congress that the time has arrived to begin the conservation of our mineral fuels, and urging upon that body the passage of laws upon the subject.

In the older fields of the east, with the exception of Indian Territory, practically all of the coal land has passed to private ownership. Therefore the present order and the interest of the people generally centers about the coal fields of the Rocky Mountain region and the Pacific slope. The former contains an area estimated at 134,800 square miles, and the latter, including Alaska, 10,000 square miles, or a total of 144,800 square miles out of a total for the whole country of 400,500 square miles.

Of this area of 144,800 square miles of coal fields of the western states, it is estimated that 50 per cent has passed to private ownership, leaving about 72,000 square miles of coal fields yet belonging to the government. It must be remembered, however, that more than half of this area is included in the lignite fields of eastern Montana, North Dakota, and South Dakota, and when this is deducted from the figures given above it leaves an

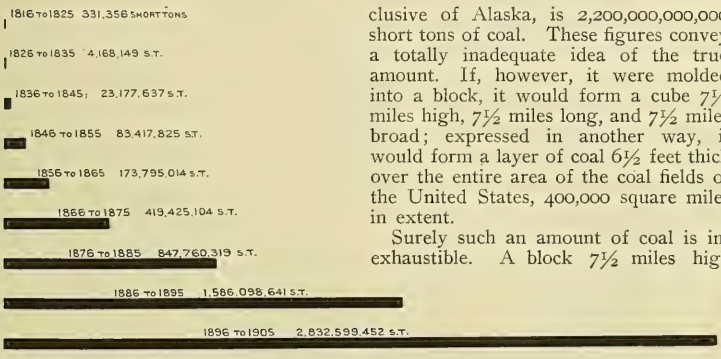


Diagram Showing the Increasing Rate of Consumption of Coal in the United States

area of only about 33,000 square miles of fairly good coal, the title to which is still vested in the United States.

Have we an inexhaustible supply of coal, as many would have us believe, or should we begin to husband our resources? Is the government justified in withdrawing all coal from sale, as proposed in the recent message of the President to Congress? The answer to these questions depends largely upon the broad problem of what is the extent of our coal supply, how rapidly are we using it, and is there a possibility that our stock of fuel will be exhausted in the near future?

In order to answer these questions, the writer has attempted to estimate the amount of coal yet remaining in the coal fields of the country. Such an estimate must necessarily be vague and unsatisfactory for the reason that our knowledge of the coal fields is limited, but recent reconnaissance surveys have been made over the most important coal fields of the west, and now it is possible to make an estimate of their approximate contents.

THE ESTIMATED AMOUNT OF COAL IN THE UNITED STATES FIELDS

According to this estimate, the total tonnage of coal in the United States, exclusive of Alaska, is 2,200,000,000,000 short tons of coal. These figures convey a totally inadequate idea of the true amount. If, however, it were molded into a block, it would form a cube 7½ miles high, 7½ miles long, and 7½ miles broad; expressed in another way, it would form a layer of coal 6½ feet thick over the entire area of the coal fields of the United States, 400,000 square miles in extent.

Surely such an amount of coal is inexhaustible. A block 7½ miles high would tower above the highest mountains on the earth. Is it possible that the people of this country can use such a mass of coal? Before the question is answered we must determine the rate of coal consumption and study the factors of which it is composed to see if they are liable to fluctuate greatly in the near future. The following diagram, prepared from statistics of coal production collected by Mr E. W. Parker, of the United States Geological Survey, shows graphically the amount of coal produced in each decade since 1816.

WILL OUR COAL LAST 100 YEARS?

The actual consumption of coal in the United States during this period has been somewhat greater than that shown by the diagram, for some coal has been imported, but the diagram shows the rate at which we have been using our own coal. The rate of increase is enormous; it is simply appalling. As shown by the diagram, the amount produced in any one decade is equal to the entire previous production. The curve indicating the increase seems to be going off into the future in a straight line, and this means an increased production that no supply, however great, can withstand for many years.

If the rate of consumption of 1905 were maintained indefinitely, without change, our coal would last approximately 4,000 years, but if the constantly increasing rate which has marked the consumption during the past 90 years be maintained, our coal will practically be exhausted within 100 years.

The question now remains, Will this increasing rate hold? In order to answer that question we must analyze the present consumption to see whether all of the factors composing it will probably continue to increase in the future as they have done in the past.

A large part of the coal produced in this country is consumed by the railroads. According to an estimate prepared by the Interstate Commerce Commission, the amount of coal consumed by locomotives in 1905 amounted to 106,000,000 tons. Will this increase or decrease in the future? While it is possible that railroad building in the future will not be so active as it has been in the past, there is every prospect of a great and growing increase in the traffic of existing lines, and this will lead to a constantly increasing consumption of coal unless some new source of power is discovered. The same argument applies to steamship lines, to manufacturing, and to domestic consumption of coal. In view of these considerations, it does not seem probable that the rate of increased consumption will be affected materially for a great many years to come, and hence the estimate of 100 years will be nearer the truth than 4,000 years. The real life of our coal fields probably will be somewhere between these extremes, and it seems probable that it may be about 200 years.

If this estimate is even approximately correct, is it not time for the government to take some steps to prevent the remaining coal of the west from passing to the hands of corporations, to prevent wasteful methods of mining and use, and to conserve for the use of the common people even this small fraction of the total coal of the country? No doubt there is a great difference of opinion on this subject, but it is hard to see how any fair-minded person interested in the good of the people of this country rather than the corporations can look upon the present situation with other than concern, and can fail to unite in an effort to avert the evil consequences that may be in store for future generations.

EFFORTS TO OBTAIN GREATER ENERGY FROM COAL

REALIZING the rapidity with which our coals are being consumed, the government several years ago established in connection with the United States Geological Survey a coal-testing plant to ascertain (1) means by which more energy can be obtained from coal, and (2) whether some of the coals and lignites previously considered of little value cannot be utilized. The waste of the energy of coal in the ordinary steam boiler is tremendous, it being calculated that only from 5 to 7 per cent of the energy is secured. The remaining 93 to 95 per cent is lost, owing principally to wasteful and imperfect methods of combustion. Prof. Joseph A. Holmes summarizes the work thus far done as follows:

In connection with the work of the United States Geological Survey fuel-testing plant at St Louis, where a large number of coals from very nearly every state containing coal has been tested, some important results have been developed which would tend toward conserving the coal supply. The most important of these results show that the

vast brown and black lignite deposits of the West are available for use in the gas-producer. It has been demonstrated that brown lignite from North Dakota will produce in some cases more than four times the power when used in the gas-producer than when burned under the boiler. These lignites, containing from 20 to 45 per cent moisture, have always stood at the bottom of the scale as a boiler fuel, and they have been used for power purposes only where it has been impossible to secure bituminous coal. It was discovered at the Geological Survey coal-testing plant that these lignites, in spite of their high moisture content, can be utilized commercially to the best advantage in the gas-producer equipment.

In the boiler-room of the fuel-testing plant, where careful study has been made of combustion and the conditions governing the methods of firing the various coals of the United States, it has been shown that through proper stoking and superintendence the coal bill of the country could be considerably reduced by this careful attention to details which is too often neglected in the average commercial plant.

A force of specially trained experts has been at work for some time making a careful study of coals which contain too much ash or sulphur to be available for commercial purposes. These investigations have been carried on both in the laboratory and in the field, and the results obtained so far look forward to a time when these dirty coals can be greatly improved by proper washing or other means of mechanical preparation, and as a result many low-grade coals will be extensively operated.

The briquetting of slack coal and other waste sizes has been successfully accomplished at a low cost. The resultant briquettes have proved superior, in almost all cases, to lump coal from the same mines for power purposes. This branch of the investigations opens to the commercial world a hitherto unknown field which is destined soon to become an important factor in the production of fuel.

The following tabular statement shows the comparative efficiencies of a number of coals tested in the gas-producer and burned under boilers, demonstrating the economy of the gas-producer equipment:

Table showing the relative efficiency of coals used under the steam boiler and in the producer-gas plant at the U. S. Geological Survey fuel-testing plant, St. Louis, Mo., in 1904 and 1905.

(By Marius R. Campbell.)

No.	Name of coal tested.	Steam.	Ratio.	Producer gas (one electrical horse-power per hour equals 1,000).
1	West Virginia (13)	0.287	3.34	0.961
2	West Virginia (14)	.276	3.29	.909
3	West Virginia (18)	.275	3.03	.883
4	Virginia (3)	.279	2.60	.826
5	Ohio (5)	.246	3.23	.794
6	Pennsylvania (5)	.273	2.86	.781
7	Pennsylvania (8)	.285	2.74	.781
8	Ohio (6)	.249	3.10	.770
9	Virginia (4)	.265	2.88	.763
10	West Virginia (20)	.281	2 71	.763
11	Pennsylvania (10)	.278	2.72	.758
12	West Virginia (4)	.269	2.82	.758
13	Kentucky (6)	.270	2.79	.752
14	Ohio (4)	.246	3.04	.746
15	Pennsylvania (6)	.256	2.85	.730
16	Virginia (2)	.262	2.77	.725
17	Illinois (19)	.223	3.22	.719
18	Kentucky (5)	.279	2.59	.719
19	West Virginia (16)			.714
20	Kentucky (1)	.262	2.71	.709
21	Pennsylvania (4)	.272	2.59	.704
22	West Virginia (9)	.279	2.51	.701
23	Ohio (9)	.242	2.89	.700
24	West Virginia (7)	.274	2.43	.667
25	Ohio (3)	.234	2.83	.662
26	West Virginia (12)	.278	2.35	.654
27	Virginia (1)	.271	2.41	.653
28	Ohio (8)	.236	2.69	.641
29	Indian Territory (4)	.202	3.15	.637
30	Illinois (10)	.190	3.31	.629
31	West Virginia (1)	.251	2.42	.625
32	Indiana (8)	.214	2.90	.621
33	Indiana (7)	.212	2.86	.606
34	Kentucky (7)	.224	2.71	.606
35	Ohio (7)	.238	2.51	.599
36	Pennsylvania (7)	.256	2.32	.599
37	Kansas (5)	.243	2.44	.592
38	Alabama (2)	.233	2.51	.585
39	Indiana (11)	.227	2.55	.578
40	Illinois (13)	.227	2.53	.575
41	Illinois (18)	.212	2.71	.575
42	Illinois (14)	.187	2.99	.559
43	Illinois (15)	.206	2.70	.556
44	Illinois (16)	.236	2.34	.553
45	West Virginia (8)	.261	2.10	.549
46	Indiana (5)	.209	2.61	.546
47	Indiana (9)	.212	2.56	.543
48	Illinois (11)	.196	2.67	.523
49	Indian Territory (1)	.229	2.28	.521
50	Illinois (3)	.211	2.45	.518
51	Indiana (6)	.207	2.49	.515
52	Indiana (3)	.203	2.50	.508
53	Illinois (6)	.157	3.22	.505
54	Illinois (9)	.171	2.91	.498
55	Illinois (6)	.159	3.11	.495
56	Illinois (4)	.181	2.71	.491
57	Wyoming (3)	.174	2.82	.490
58	Kentucky (3)	.218	2.24	.488

One of the most important lines of investigation being conducted by the experts of the fuel-testing plant is the study of coal mines throughout the country to determine, where certain portions of the bed are being discarded, if it is not possible to utilize the discarded portion for power or other purposes. At the present time gas-producer tests are being made on "bone" coal containing from 45 per cent of ash upward. So far no difficulty has been encountered in running the producer plant on this material. This "bone" coal has always been looked upon by the miners as a waste product, and is being mined and discarded in many localities, notably the Hocking Valley region in Ohio.

The old dumps are available as well as the "bone" which is in place in the mines, and should the experiments now being conducted at the fuel-testing plant prove entirely successful, there should be a market for this material.

POLAR PHOTOGRAPHY

By Anthony Fiala

Leader of the Ziegler Polar Expedition, 1903–1905, and Author of "Fighting the Polar Ice"

THE sun shines day and night through the short Arctic summer, revolving like the hour hand of a great clock in the dome of the sky not far above the circle of the horizon. With the blazing luminary and the vast white stretches of snow and ice, there ought to be no lack of light—a veritable paradise for the photographer.

At first sight it would seem that with all this dazzling brilliancy over-exposure would be the evil to guard against, and that comparatively small openings and quick speeds would be the rule for lenses and shutters. But no! Though the Arctic explorer may travel in danger of snow-blindness in a flood of light, direct and reflected, he soon finds that the actinic value of sunlight is less than in lower latitudes—in fact, surprisingly little—and he is obliged to use his very quickest lenses, and then with their widest openings use the slowest speed consistent with the movement of the men and animals which he photographs on the crystal fields.

On my first Arctic expedition I took color screens, but only used them or tried to use them a few times. I soon found that, instead of giving color and character to the views, they flattened and deadened the pictures of ice and snow and lengthened the exposure to hopelessly long intervals of time. The reason for this is the low altitude of the sun and the consequent high refraction, which gives more of the yellow and red rays than of the blues, as is the case with an evening sun in our own latitude.

With so much reflected light, the pictures would suffer for want of shadows, and I soon found that to get good values in ice pictures it was necessary to photograph with the sun in such a position that the long shadows cast between the ice blocks by the low orb could be used to accentuate the high lights and give character and contrast. To that end, it was necessary to have the sun either at the right or left hand, and often I exposed a film pointing the lens directly at the sun.

The artist who attempts to photograph the ice-fields after the time-honored custom of always having the sun behind his back will generally be doomed to flat, insipid negatives and almost meaningless pictures unless he can find shadows enough in the foreground to give character to the view.

In regard to apparatus and material, around the ship and hut any good camera can be used. I had several sizes. On the first expedition I took a number of glass plates, but was unfortunate enough to break some of my best negatives, so when I went into the field again I took nothing but films. On the sledge journeys, where the question of weight is of great consequence, the lightest form of camera is sure to be the favorite. In my last trip over the moving polar pack I found that a kodak was about the most convenient, and took with me a panoram kodak (which weighed with its leather case only four and a half pounds) and a small supply of films in water-tight tin tubes.

On a sledge journey the camera and films were always kept in the outer air, usually in a compartment of the canoe that was lashed to one of the sledges. During low temperatures, the interior of a tent is not the place in which to load a camera. The little difference in temperature between the air of the shelter and of the outside is sufficient to cause condensation of moisture and the cold lenses and metal work of the instrument coat with a film of ice. Often, as I stood with my back to the sun in an endeavor to shade the camera as much as possible, with a temperature of from 30 to 40° below zero, I have struggled with the little catches of the kodak and have had my fingers stick to the cold metal of the tin tubes containing the films while taking out an exposed roll and reloading the camera with a new one. Care had also to be exercised to keep the instrument from being frosted by the vapor from hands and body. It was always with a feeling of thankfulness and relief that the camera was made ready and I could slip my half-frozen hands into mittens and by swinging the arms and performing a sort of Indian war dance restore circulation. On return to camp the films were all developed in an improvised dark-room with a small alcohol lamp to keep the developer at about 60 degrees temperature. I believe the new tank developer would be just the thing for explorers and particularly good for developing films exposed in the Arctic, where long development is absolutely necessary to insure good results. Part of the outfit comprised a bioscope, a form of moving-picture camera, with which I hoped to secure views of men, dogs, and ponies moving over the ice-fields, the advance of the *America* through the ice, and, if possible, a bear fight. Of all my photographic apparatus, the bioscope gave me the most trouble, particularly in the low temperatures of spring and early autumn. The long celluloid film upon which the numerous little negatives were made (twenty to a second) became very brittle under the influence of the extreme cold, and would fly to pieces when the mechanism of the instrument was started, and pieces of celluloid would clog the gear wheels and jam between moving parts. After many failures, I hit upon the plan of warming the machine and wrapping it up in hot blankets just before taking a picture. The heating and wrapping up was done in the hut at camp. I was thus enabled to secure some valuable films; a few of them reached a length of 300 feet. But always, as soon as the instrument became cold, the films broke like fragile glass. It was impossible to warm the bioscope on the trail, so I was limited to views near the ship and in the vicinity of camp.

We shot a number of bears for food. A bear fighting for his life, surrounded by a biting, snarling pack of dogs, would have been a splendid subject for a motion-picture camera; but I was never so fortunate as to have camera and fight at the same time.

The pictures which show the ponies and dogs hauling their loaded sledges over the ice bring back in vivid reality the cold, white fields and the struggling men and animals fighting their way over the frozen wastes.

The explorer with a camera has gone over very nearly all the earth and has brought back as part of his record views of life and land in the far-off parts of the earth.

There is still land to be conquered; and it is good to know that when these unknown places are found and the flags of discovery are planted, that with the help of the sun and modern chemistry, we will all be able to view with the explorer what had once been forbidden and mysterious territory.

NOTES ON THE FOREST SERVICE

THE Forest Service of the United States has under its control today property which exceeds in value all the forts, the arsenals, the warships, and the navy-yards controlled by the War and Navy Departments combined. The number of forest reserves in various parts of the country, but mainly in the far West, is over 100, and the number is being continually increased. The present area of these reserves is over 125,000,000 acres, an area equal to that of all the north Atlantic and middle Atlantic states as far south as Virginia. The approximate value of the present forest reserves may be estimated as follows:

Stumpage value of 330 billion feet of timber at $2 per 1000..	$660,000,000
110 million acres, capable of producing commercial forest, at $1 per acre	110,000,000
110 million acres of range for grazing live stock, at 1½ cents per acre (capitalized at 5 per cent)	30,000,000
83 million acre-feet of water for irrigation purposes, at 10 cents per acre-foot (capitalized at 5 per cent)	166,000,000
Three million horse-power-capable of being developed from water in reserves, at $10 per horse-power (capitalized at 5 per cent)	600,000,000
Estimated value of occupancy and use of reserve land, products and resources additional to the above	5,000,000
Permanent improvements now on the reserves (roads, trails, cabins, telephones, etc.)	5,000,000
Total	$1,576,000,000
Less 10 per cent for private holdings	157,600,000
	$1,418,400,000

NEED OF FOREST RESERVES IN THE EAST

But while the far West is literally dotted with forest reserves, the East has almost no reserves. There is, however, now pending in Congress a bill, already passed by the Senate, which would create a White Mountain forest reserve in the State of New Hampshire, to comprise approximately 812,000 acres. There are, of course, no public lands in New Hampshire, and therefore the national government must buy the land from private owners. The national government must buy it because the benefit which will accrue from the reservation will be not alone for New Hampshire, but for all the New England states, save possibly Rhode Island. Elaborate arguments were made last spring before the Agricultural Committee of the House of Representatives, which has this bill in charge. The bill provides for an appropriation of $3,000,000 for the White Mountain reserve, and also for a larger reserve in the Appalachian Mountains, in the southern states. At the hearings before the committee it was abundantly proved that the creation of these reserves, and that without further delay, is a matter of the highest importance to the respective sections in which they are located. The injurious effect upon the Connecticut River of the destruction of the White Mountain forests was so amply testified to as to be beyond question.

PLAN TO MAKE THE FOREST RESERVES SELF-SUPPORTING*

The money value of the national forests now reserved for the use and benefit

* Extract from a recent message to Congress by President Roosevelt.

Sand Spreading Over Fertile Soil, Catawba River Lowlands

Appalachian Mountain Field Completely Ruined by Erosion

Both pictures show the frequent results of reckless destruction of the forests

Cypress and Eucalyptus Lining An Irrigating Ditch, Forming a Windbreak, Southern California

of the people exceeds considerably the sum of one thousand million dollars. But this vast domain is withheld from serving the nation as freely and fully as it might by the lack of capital to develop it. The yearly running expenses are met by the annual appropriation and the proceeds of the forests. Under the care of the Forest Service the latter are increasing at the rate of more than half a million dollars a year. The estimate of the appropriation for the present year is less than that for last year, and *it is confidently expected that by 1910 the Forest Service will be entirely self-supporting.* In the meantime there is the most urgent need for trails, fences, cabins for the rangers, bridges, telephone lines, and the other items of equipment without which the reserves cannot be protected properly and cannot contribute as they should to the general welfare. Expenditures for such permanent improvements are properly chargeable to capital account. The lack of reasonable working equipment weakens the protection of the national forests and greatly limits their production. This want cannot be supplied from the appropriation for running expenses. The need is urgent. Accordingly I recommend that the Secretary of the Treasury be authorized to advance to the Forest Service, upon the security of the standing timber, an amount, say $5,000,000, sufficient to provide a reasonable working capital for the national forests, to bear interest and to be repaid in annual installments beginning in ten years.

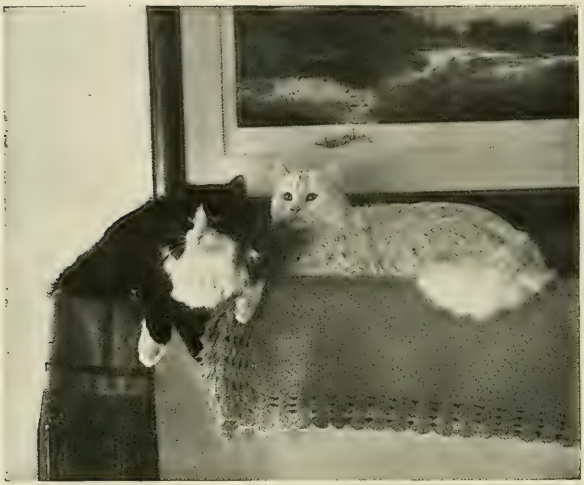
WOLVES

THE enormous losses suffered by stockmen on the western cattle ranges and the destruction of game on forest reserves, game reserves, and in the national parks through the depredations of wolves have led to special investigations by the Biological Survey, in coöperation with the Forest Service, to ascertain the best methods for destroying these pests. The results appear in a report by Mr Vernon Bailey, of the Biological Survey, which includes also field notes on the distribution, abundance, and breeding habits of wolves. (Forest Service Bulletin 72.)

The chief object of the report is to put into the hands of every hunter, trapper, forest ranger, and ranchman directions for trapping, poisoning, and hunting wolves and finding the dens of young.

The wolves of North America are divided into two groups—the smaller coyotes, or prairie wolves, of the western United States, Mexico, and southwestern Canada, comprising several species and subspecies; and the larger gray, black, or timber wolves, distributed practically throughout the whole of North America from Florida and the table-land of Mexico to the Arctic Ocean. These large wolves—commonly called "loafers" or "lobos"—include at least half a dozen species or geographic races, comprising the small dark gray or black wolf of Florida and the southeastern United States, the red wolf of southern Texas, the brindled wolf of Mexico, the light-gray wolf of the Central Plains region, the dark-gray wolf of eastern Canada, the almost white wolf of northern Canada and Alaska, and the large black or dusky wolf of the Northwest Coast region. Their habits differ mainly in adaptation to the varied conditions of their environment—timber, plains, mountains, deserts, or northern barren grounds —and in the methods of pursuit and capture of different kinds of animals for food.

Wolves still occupy most of their original range, except where crowded out of the more thickly settled regions. The large gray wolf of the plains and middle west is at present the most abundant



Persian Cats in Hamadan

From "Persia Past and Present." By A. V. Williams Jackson. Copyright by The Macmillan Co.

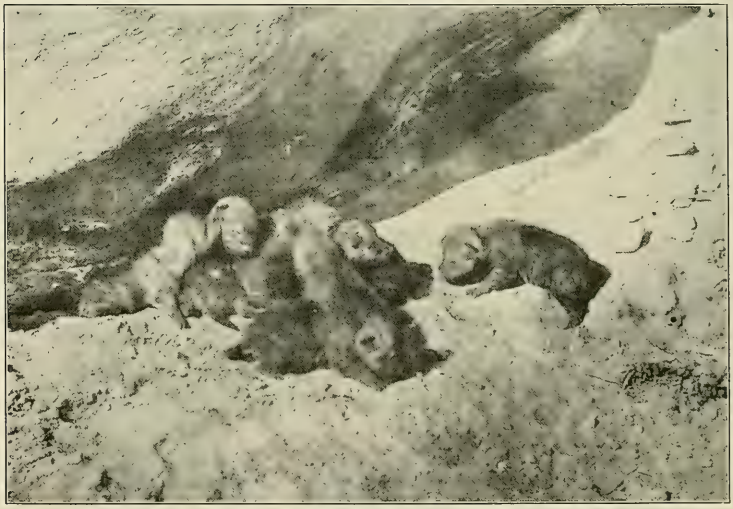


Photo by Vernon Bailey, U. S. Bureau of Biological Survey

Nine Wolf Pups in Front of Their Den

species in the United States and the most destructive to stock. Over the thinly settled ranch country of Montana, the western parts of the Dakotas and Nebraska, and of Wyoming, Colorado, New Mexico, and western Texas, where stock-raising is the principal industry, the wolves have held their own, and in favorable sections have increased since the destruction of their former prey, the buffalo, and the introduction of still greater numbers of domestic cattle—this, too, in the face of a fierce warfare waged by ranchmen, trappers, and hunters.

GEOGRAPHIC LITERATURE

Climatology of the United States. By A. J. Henry. Bull. Q., U. S. Weather Bureau. 4to., pp. 1012. Washington, D. C.: Government Printing Office. 1906.

This is probably the most important publication ever issued by the Weather Bureau, inasmuch as it comprises an exhaustive summary of the meteorological data down to date, collected by the Signal Service and the Weather Bureau.

The first 84 pages are devoted to a discussion of the climates of the country, element by element—atmospheric pressure, storms, winds, temperatures, precipitation, humidity, and cloudiness. This part of the work is profusely illustrated with maps and diagrams.

The body of the book is composed of meteorological statistics of 690 Weather Bureau stations, distributed over the country as uniformly as practicable. Each station is fully described, with position, elevation, history, and equipment. The data given for each station are as follows, as fully as possible: For each month, each season, and the year, the normal temperature, the mean of the maxima and the absolute maximum temperatures, the mean of the minima and the absolute minimum temperatures, and the highest and lowest monthly mean temperatures; the normal precipitation, the number of days with more than a trace of precipitation, the total amount in the dryest and wettest years, the average depth of snow, and the greatest depth in 24 hours, the mean relative and absolute humidity and amount of sunshine, and finally the direction of the prevalent wind; then follow dates of temperature extremes.

The stations are arranged geographically by states, and those of each state are preceded by a physical description of the state and a summary of the climatic data.

Students of American climate will find this work invaluable. It is to be hoped that every other country having a meteorological service will prepare a similar work. H. G.

The Wonders of the Colorado Desert. By George Wharton James. 2 vols., 8vo., pp. 44+547. Illustrated. Boston: Little, Brown & Co. 1906. $5.00.

This sumptuous book describes a region which for the past two years has been very much in the public eye, for it is that also known as the Salton Desert, into which the Colorado River is pouring its waters and re-creating a lake in its midst. The story is here told at length, with an account of the numerous attempts made to close the gap in the natural levee and restore the river to its former channel; but this forms but a small part of the book. The aspect of the desert, its strange vegetable and animal inhabitants, its mountains and sand dunes, its delights and dangers, its history, are all described by one who feels the call of the desert and has the skill to picture it. With these descriptions are intercalated legends of lost mines, tragedies, narratives of journeys, and among the latter a boat trip down the outflow from the Colorado to the Salton Lake—a strange trip in a strange region.

The book is beautifully and lavishly illustrated, in part by half-tones from photographs by the author and in part by sketches from the pencil of Mr Carl Eytel. The map is by no means, in point of execution, on a par with the rest of the work. H. G.

Romantic Cities of Provence. By Mona Caird. Pp. 413. 6½ by 9 inches. Illustrated. New York: Imported by Charles Scribner's Sons. 1906. $3.75 *net.*

The author tells in a delightfully personal way of a journey through the south of France, that wonder country of the ancients, where the ruins of an amphitheater, arch, or massive bridge erected during the Roman occupation, about 40 B. C., is regarded as being quite modern. The writer gives a vast amount of historical information, with anecdote and legends of the birth of chivalry and its offspring, the Troubadours, who ruled France with their music. The volume is enriched throughout with many splendid sketches of Provence, Arles, Avignon, Beaucaire, and Nimes by Joseph Pennell and Edward Synge. Much attention is given to the architecture of the ancients as well as that of the Renaissance, and it is quite evident that the volume is not written as a text-book, but rather for those who have at least a passing acquaintance with Provence and its brilliant history. J. O. L.

The Heart of England. By Edward Thomas. Pp. 360. 8 by 10½ inches. Illustrated. New York: E. P. Dutton & Co. 1906. $6.00 *net.*

The author, having made a study of the quaint old customs of England, tells of them in a pleasing way. Throughout the shires of England many customs and habits have been handed down from father to son through centuries. These have been collected from many

out-of-the-way places, and the volume will be welcomed by those who love the old traditions and folklore, which are fast being lost to view amid the progress and hurry of today. A number of old English ballads are given, many of which have not been before published in our generation. The author has quite caught the real atmosphere of rural England, and a number of beautiful colored illustrations by H. L. Richardson add in a great measure to the attractiveness of the volume. J. O. L.

Geography of Nebraska. By George Everet Condra. Pp. 192. 5 by 7½ inches. Lincoln, Nebraska: University Publishing Co. 1906.

This little geography has been written for the school children of Nebraska, and contains chapters on the formation of the soil and rock beds of Nebraska, on atmospheric conditions, illustrated with weather charts, and on the methods of reclamation—irrigation, forestation, and dry-farming—practiced in the state. The text is illustrated with pictures, maps, and charts, and is well indexed. It is an admirable publication.

Touraine. By Anne MacDonald. Illustrated. Pp. 420. 8 by 10½ inches. New York: E. P. Dutton & Co. 1906. $6.00 *net.*

There has been much written of the south of France, with its fascinating history, but there seems to be always something new to be learned. In this volume the writer brings out of the past a wealth of legend and folklore of this ancient land of great rivers and valleys, of chateaux and marches, giving to each its song and story. The author has sought to set forth the warlike achievements as well as the untutored diplomacy of the feudal kings and rulers of this wonder country, telling in a masterly way of innumerable invasions, of heroic defense and unceasing strife, from the time of its occupation by the Celtic-Puroni, whom Cæsar's legions found there, through the dark centuries, when the fair country was given over to the ravages of Goth and Franc, of Musselman and Gaul, until the dawn of the Renaissance overspread the land. The work is magnificently illustrated by A. B. Atkinson with two-score artistic pictures in color, as well as many drawings, showing the marvelous architecture of each century, which is perpetuated in towered chateaux and cathedral, in grim fortress and shrine. The work is complete and shows the heights which the publisher's art has reached. J. O. L.

A Cruise Across Europe. By Donald Maxwell. 8 vo., pp. 254. Illustrated. New York and London: John Lane. 1907.

A delightful narrative of a sail in a small boat up the Rhine, across to the Danube, by an old, disused canal, and the journey down the Danube to the Black Sea. Most of the route is remote from the track of the tourist, and the travelers, two young Englishmen, have many novel adventures. H. G.

NATIONAL GEOGRAPHIC SOCIETY

POPULAR MEETINGS.

February 1—"The Rising Pacific Empire." By Mr George C. Perkins, Senator from California.

February 8—"The Guianas." By Prof. Angelo Heilprin, of Yale University. Illustrated.

February 12—"Labrador: Its People and Conditions of Life." By Dr Wilfred T. Grenfell, C. M. G., special medical missionary of the Labrador Coast. Illustrated.

February 15—"The First Ascent of Mount McKinley." By Dr Frederick A. Cook. Illustrated.

March 1—"Santo Domingo and Haiti." By Rear Admiral Chester, U. S. Navy. Illustrated.

March 11—"Millions for Moisture." By Mr C. J. Blanchard, who will give an account of the Reclamation Service, and also of the Salton Lake, formed by the break of the Colorado River.

March 15—"Ten Years of Polar Work; or, What We Know and What We Want to Know." By Mr Herbert L. Bridgman, Secretary of the Peary Arctic Club. Illustrated.

March 23—"Queer Methods of Travel in Curious Corners of the World." By Hon. O. P. Austin.

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March 22—"The U. S. Forest Service." By Mr Gifford Pinchot, Forester. Illustrated. The Forest Service has charge of 114,606,058 acres of forest land, worth $400,000,000.

March 26—"Utilizing the Surface Waters of the United States for Power." By Mr H. A. Pressey, C. E. Illustrated.

April 6—"The South Sea Islanders." By Mr A. B. Alexander, of the U. S. Bureau of Fisheries. Illustrated.

April 15—"Photographs of Wild Game Taken by Themselves." By Hon. George Shiras, 3d. Illustrated.

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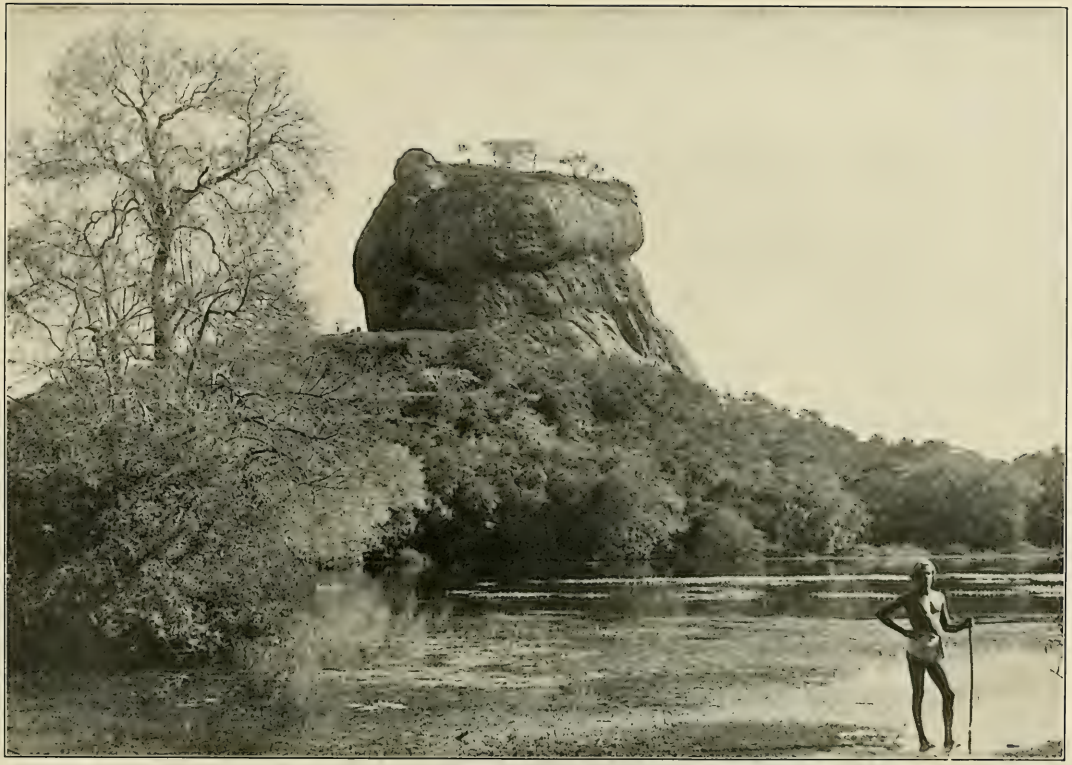

The Sigiri Rock in Ceylon

The guard-house terrace from which the ascent by ladders is made is shown on the left

Vol. XVIII, No. 3 WASHINGTON March, 1907

THE NATIONAL GEOGRAPHIC MAGAZINE

ARCHÆOLOGY IN THE AIR

By Eliza R. Scidmore

Author of "Java—the Garden of the East," "Winter India," etc. etc.

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WHEN I was first in Ceylon and had driven the seventy miles down to Anuradhapura and seventy miles back again to Kandy, the archæologists had not taken Sigiri in hand, and no tale of its wonders tempted us from the straight and smooth post-road. Ten years later every one talked of Sigiri, and its fame was in the very air. Copies of wonderfully preserved frescoes, done on Sigiri's rock walls fourteen centuries ago, met one in the Colombo Museum, and driving parties came into Kandy and urged me to go to Sigiri by all means; but none of these talkers had "climbed the Rock," whatever that might mean.

Ceylon, in its natural beauties, is a fair pattern for Paradise, second only to Java—the most beautiful country on earth—and one appreciates this paradise the more if he takes long driving trips over the perfect roads. The short drive of sixteen miles from Kandy down to Matale is renowned as the finest drive in Ceylon and is an unbroken panorama of ideal, cultivated tropical beauty. For another ten miles the road is arched over with tamarind trees, festooned with pepper vines, and sentinelled here and there with splendid banyans and talipot palms, with the blue Matale mountains in the background. After that, cultivation lags, a few miles of rice fields follow, and one jogs along past the unending jungle of the abandoned lowlands, where scant rains fall only during three months of the year. This region was once the richest and most fertile in Ceylon, a vast rice plain abundantly irrigated from tanks and lakes that stored water beyond all need. This rich plain and Anuradhapura, a city of fabulous wealth, tempted the Tamils of the Indian mainland to many raids, and after a last invasion the marauders destroyed all the tanks and canals before they retreated to the Continent. Drought, disease, and famine swept away the few remaining inhabitants, jungle overran the territory, and wild elephants trumpeted there undisturbed. Their paths and the pilgrim's path through to the sacred Bo-Tree at Anuradhapura were the only roads in the wilderness, until coffee culture on the Matale hills tempted Tamil coolies over to Jaffna, whence they made their way on foot to Kandy and the plantations.

For this last half century, British governors have tried to redeem this rich country and repopulate it. A post-road, with rest-houses, was built through to Jaffna and to Trincomalee, the old tanks were cleared out and walled round again, and a railway projected from Colombo around through the lowlands to Anuradhapura and Jaffna. The archæological survey found work to do far beyond the limits of the appropriations, but the wonders of ancient art they have uncovered at Anuradhapura,* Mihintale, and Sigiri furnish attractions to the winter tourists, who are a very certain source of revenue to Ceylon.

ON THE ROAD TO SIGIRI

Breakfasting by candle light at Matale rest-house, one may start at six o'clock and drive through the very tolerable substitute for Eden that the tropical world can present in that clearest, freshest hour of day. Minæ birds sang from tall trees and cocoa trees, and that grotesque home friend, the woodpecker, drummed on all sorts of strange tree trunks. The woodpecker and the cocoa palm tree are not associated ideas with us of temperate America, to whose minds the rolling notes and scolding chatter of a woodpecker conjures up any other picture.

The road dropped away between great plantations, where the long-leafed, hybrid, Assam tea bushes striped the red earth in endless lines and feathery grevillea trees shaded the bushes in as precise rows. One tea plantation bordered for three miles along the road, where great arks of bullock carts—prairie schooners with thatched roofs—creaked their way, hung over the outside with bunches of fodder and cooking pots, and bursting open with their freight of women and children and household effects. Gay young planters pranced by on Arab horses or sped along in dog carts. Strings of spindle-legged Tamils came on from Jaffna seeking plantation work and carrying all their possessions tied in a bundle on their heads, including even the sun umbrella. Hedges of aloes, hibiscus, and lantana, rows of tall tamarind trees festooned with pepper vines, and always the graceful plumes of cocoa palms against blue sky, made the common highway like the ideal scenes of a theater drop-curtain. Groups of Tamil women in white and brilliant red head draperies seemed posed beside the brilliant green tea bushes, and to be tossing tea leaves over their shoulders into cylindrical baskets on their backs, only while they waited for the photographer or the sketch class to arrive. When the kodak did arrive before one black beauty, with jeweled rings in her nose and a mite of a black baby astride of her hip, she pulled her veil over her face and set up a howl. Promises of a money reward did not seem to reach her ear, but they reached the ears of a few dozen others, who came running, and with whoops and shrieks precipitated themselves upon the tea bush my kodak pointed to. Then the black overseer came, with black looks on the blackest face ever seen, and with his big walking stick cleared the magpie mob away and made the young mother stand up and look pleasant in the act of picking tea. For this she, or rather the baby, received the promised tiny silver piece, which the pickaninny quickly swallowed, and there was uproar again as we drove away.

A few rows of shops now and then constituted the village bazars, where the estate coolies are tempted to dissipate, to spend for bananas and cocoanuts, red peppers and curry stuff, or for brilliant calicoes and gay teapots. Three shining figures of black bronze sat under a thatched roof molding red clay on the potters' wheel, and a yellow bronze Arab baby ran out, clothed only in coral beads and bits of hammered silver. A bearded Cingalese patriarch, nearly air-clad, rested under a banyan tree, and a bronze Cupid leaned lovingly against him. Then estates and busy village bazars ceased, rice fields began, and the cool white gov-

*See November, 1906, National Geographic Magazine for description of ruins at Anuradhapura.

Country Carts, Ceylon

Picking Tea

ernment rest-house at Nalanda, in a compound shaded by enormous tamarind trees, marked the end of the hill country. After that was only the flat plain, covered with jungle, the white road running between a double wall of uninteresting foliage and underbrush, as monotonous as anything in Illinois. Nothing tropical appeared save the millions of butterflies that fluttered over the road, and the gor-

geous clusters of plumy red and yellow *Gloriosa superba*—the most splendid wild flower in the world, fully worthy of its superlative name.

THE RED MONOLITH

Dambool rest-house received and revived us after the twenty-mile drive, and from Dambool rock, the red monolith of Sigiri rises squarely and sharply from over the ten-mile level of tree tops—an enchanted mesa that burned blood red and purple in the sunset and seemed impossible of attainment by any two-footed climber. The bare red rock, bulging at the top and overhanging its base all around, without crevice or chimney to give access, gave us forebodings for the morrow.

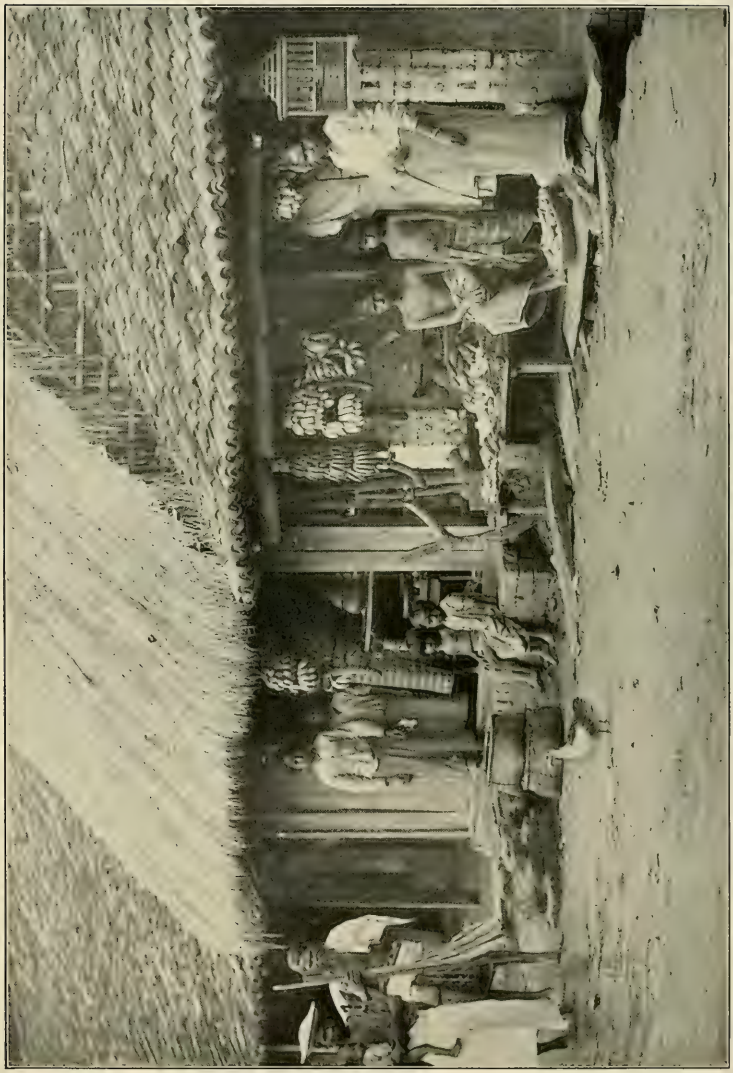
At the rest-house dinner table tales were told of travelers who drove over to climb Sigiri—and drove back again; of heroic ones who climbed the first quartz staircases airily, but sat down at the guard-house terrace, and wept hysterically at sight of the scaling ladders hanging in air, when it was time for them to climb and cling by foot and hand, by tooth and nail. They told of others who arrived on high, but sat there half a day, until hunger nerved them to a blindfolded descent; two coolies with a rope, and four coolies, each to tend and place a hand or a foot, assisting the descent, for a day's wages apiece. This archæology in the air seemed rather too sensational for any one but Santos-Dumont, and there was a profound wish that we had kept Sigiri to ourselves until the deed was done—or declined unknown. What was Sigiri to us, anyhow? Who had ever heard of it in America?

We left the Anuradhapura road two miles out from Dambool and followed the Trincomalie road for three miles before turning off into a jungle path that led for six miles through the leafy wilderness to the lone Lion Rock—a drive of enchantment through the azure air of the earliest morning.

THE LAIR OF A WICKED KING

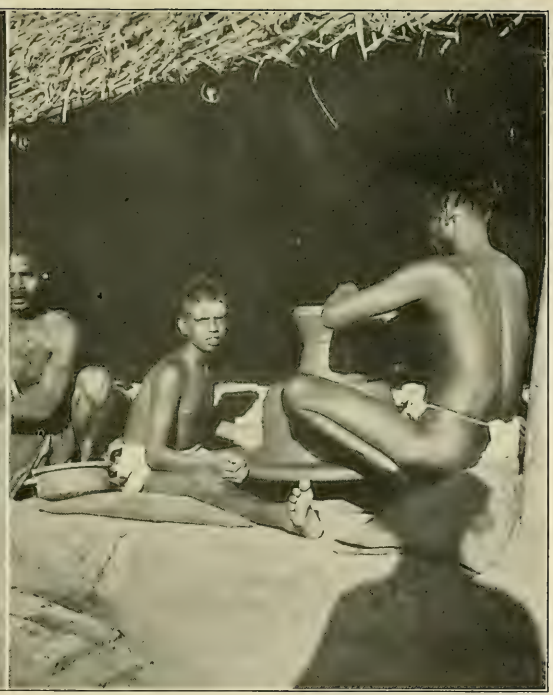
Few countries have so clear and complete an historical record as Ceylon has in the *Mahawanso,* or "Genealogy of the Great," which was scrupulously kept from the fifth century B. C. down to 1815, after the English had expelled the Dutch. The *Mahawanso* relates how King Kasyapa, having murdered his father by entombing him alive, and half murdering his brother, who fled to the Indian mainland, had thereafter an uneasy head and a bad conscience. Fearing to remain in unprotected Anuradhapura, on the open plain, he built a fortress around and a palace on top of Sigiri rock and brought a great city to its base. All the jungle round has yielded proof of the splendid structures that once stood there. The lines of tanks and canals have been traced, and the tank nearest the rock has been cleared and walled again and made useful for the little settlement that has grown around the archæologist's camp.

The government has built a small rest-house in a clearing, at just the right distance and point of view to show the boldest outlines of the tremendous monolith, and if one were seeking the ideal spot for peace and quiet, for world-forgetting, and for absolute repose, Sigiri rest-house would meet the requirements—a Nirvana, with the few necessary comforts of life. It stands at the edge of Kasyapa's viceroy's camp, which defended all access to the causeway leading across the tank to the rock and it had dependencies in the way of audience halls, halls of justice, temples, and barracks. The camp walls are of cyclopean masonry, and laid in lines of boulders that match the walls of Mycenæ and rock-girt Tiryns. Across the tank the jungle is cleared away and a confusion of bare boulders, slopes, and mounds of débris immediately surround the rock. A first stone staircase, a terrace, an iron ladder, and a second staircase brought us to the passageway between a high parapet of chunam that re-



Village Bazaar on the Road to Sigiri

The Arab Baby



The Village Pottery

The Archæologist in the Air

Climbing to Sigiri's Summit

mains from Kasyapa's time. Chunam, the universal building material of the tropic East, is a cement composed of lime, cocoanut milk, and Para tree juice. It hardens and takes a polish like marble, and where even slightly protected, as this wall has been by the overhang of the rock, will last for all time. Such a chunam screen wall once protected all these lower staircases and galleries, so that Kasyapa and his train could pass up and down, in safety, unseen from the plain. Patches of highly colored, well-preserved paintings decorate the overhanging roof of this gallery—a queen's procession, bearing flowers and offerings to the temple—similar in design and execution to the paintings on the walls of the Ajanta caves. One sees them contentedly from below, although there remain still the dizzy scaffoldings and skeletons of poles by which the archæologists reached these pockets or arches on high, to hang in mid-air while they sketched and photographed these pre-Raphaelite paintings—frescoes on the living rock, in clear yellow, green, and red, that Puvis de Chavannes might have done in an earlier incarnation, when art was pure and strong, fresh and young, and fog and smoke were not a necessary part of his palette's setting.

Another long rock staircase, hugging the side of the rock, brought us up to the broad shoulder or terrace on the north face of the mesa, where foundations show the extent of the large guard-house or barracks that defended the upper staircases of the Lion Rock. The wind blew fresh and cool over far levels of tree tops, and every prospect pleased us save that of steep overhanging Sigiri, the spidery lines of iron scaling ladders and hand rails that we had seen the black blacksmith bending from iron piping in his forge far below.

And we had brashly said, from Kandy to Dambool, that we were going to Sigiri! "And climb the Rock"? other tourists asked. Of course. Silence for a little longer would have been as gold or radium in our pockets, for we were as the most microscopic of ants about to climb the stem of a gigantic mushroom, and to crawl up over its curving, umbrella edge.

The name of Lion Rock for long had no especial significance, until on this guard-house terrace the archæologists descried three claws and the dew-claw of the feet of the gigantic lion, whose head, moulded on to the rock front, gave the name *Sinha-giri,* lion rock. Deep grooves were cut in the face of the rock as steppings for walls of masonry and the whole mass coated with chunam, and painted to the semblance of a lion's head resting on his extended paws. The king's train, passing between the paws, ascended a staircase and disappeared in the lion's mouth. The series of concealed staircases reached to the summit, where the king could emerge safely to the open air. There is trace of a portcullis half way up, the perpendicular grooves cut true and smooth, and in his palace in air Kasyapa might defy his enemies to reach him.

The lion's claws measured four and five feet across, and passing between them was the original staircase of glittering quartz, and then a long, iron ladder laid against the wall, as ladders are generally laid. The wind blew fresh from northeast and eddied up from underneath, as we mounted the rungs and looked down on dizzy vistas of far green jungle space. Then the ladder ran at right angles out in the air, parallel with the face of the rock, the gas pipe rungs driven into sockets drilled in the rock. Lizards *chuck-chucked* and ran derisively away as we advanced, the very flies kicked their heels in scorn as we clung with death grips to rails and stanchions. As we stopped to rest, and to look upward only, there were perpendicular hand rails and iron loops of steps driven in the perpendicular rock, as on the side of a ship's hold or mast. A Zermatt climber might have reveled in the prospect, but not I. On foot and knee, on all fours fairly, a solid rock slope was negotiated; and then came the gymnast's feat

up the straight steps between the grooves of the old portcullis, lifting one's weight by main force, and the worst was over. We had rounded the mushroom's lip and had only to tread in the grooves in a long, smooth rock slope, with a comforting hand rail on the side of dizzy space, as we followed around the curving rim to a final long, quartz staircase that reached the summit.

THE RUINS OF THE SUMMIT

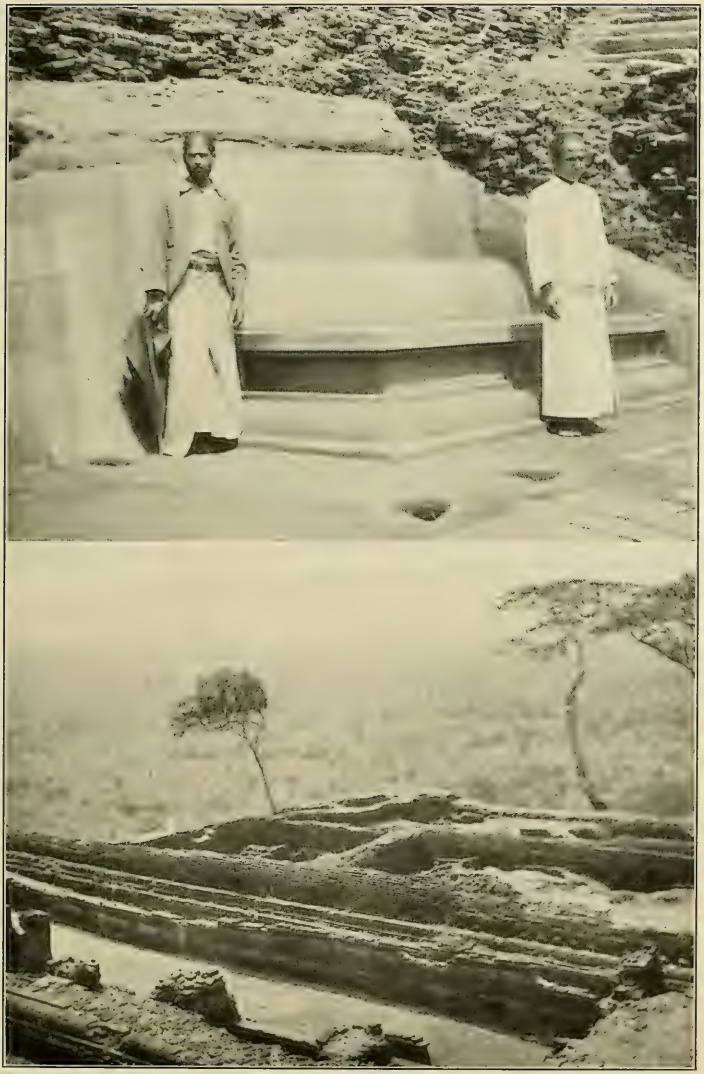
There is a space of level terraces up there quite three acres in extent, and the trees that look like saplings from below, mere tufts, few and scant as the hairs on Bismarck's head, are spreading banyans that give grateful shade from the too radiant sun. Walls and walls, lines of stone foundations and lines of crumbling bricks ran here and there, with quartz and carved stone steps in short flights, and platforms happening everywhere. The whole ground-floor plan of the king's palace has been scraped down to bed rock, hard and clean. The top-dressing of trees and bushes was burned, and then the archæologists threw the débris and rubbish over the side, and the monsoon rains washed the place clean, and they studied out the plan, as clearly as from an architect's drawing. There are wells and cisterns, and a bathing tank, thirty feet square, cut from the living rock; and a square throne or divan hewn on the eastern rim, where the king could lounge in the afternoon shade and survey his populous domains far below. There are sockets in the rock showing where the supports of a wooden pavilion roof, or the staffs for a silk canopy were set, and the seat for the umbrella-bearer behind the king's cushion is also intact. The coarse rock glitters with garnet crystals and is a natural "Jeweled Throne" that any jeweled personage of the East might envy.

Now that the foundations are all traced and cleared away, the Archæological Survey has only to maintain the staircases and ladders, and keep the place free from weeds and vegetation. The archæologist directed a coolie toward a bank of débris, just to show how rich the place was in remains of former occupancy, and the first stroke of the pick loosened a shard. Another deft stroke brought to light half of a plate, and while we marveled a coolie came up over the edge of space, as only Mahatmas are supposed to appear. He had been weeding along the dizziest edges, a rope fastened to his waist lest the suction tread of his bare feet should fail when the weed patch became vertical.

RETRIBUTION

When Kasyapa had taken his treasure and gone on high, he tried to gain peace of mind and acquire merit by pious deeds. He summoned priests around him; the rocks below were honeycombed with hermits' cells; he built temples and dagobas; he built a monastery in the air beside his palace, and was rigorous in his penances, mortification, and religious offices—but fortifying the approaches to the Lion Rock all of the time, so as to take no chances. Then retribution came over from the mainland in the train of his avenging brother, and fate had it that foolish Kasyapa, instead of sitting still and holding tight to his throne in mid-air, should come down from his high-perched palace and give battle on the low-lying plain in the commonplace way. His elephant stepped aside to escape a marshy spot and his troops, taking it as a movement of retreat, threw down their arms and ran. And the wicked king was slain by his avenging brother, as he stood, alone in an oozy swamp, after all the years of security on his wind-swept rock.

Then Sigiri was given over to the priests entirely. All the summit palace became a monastery and the uncle of Kasyapa, who began the Mahawanso, continued it there, and the abbotts of Sigiri added to the record in that ideal retreat, which is a literary landmark identified with the Mahawanso in every Cingalese mind. With time and Tamil invasions, with the wear of centuries of sun and monsoon rains, cement and ma-



The King's Throne on Sigiri

View from Sigiri's Summit

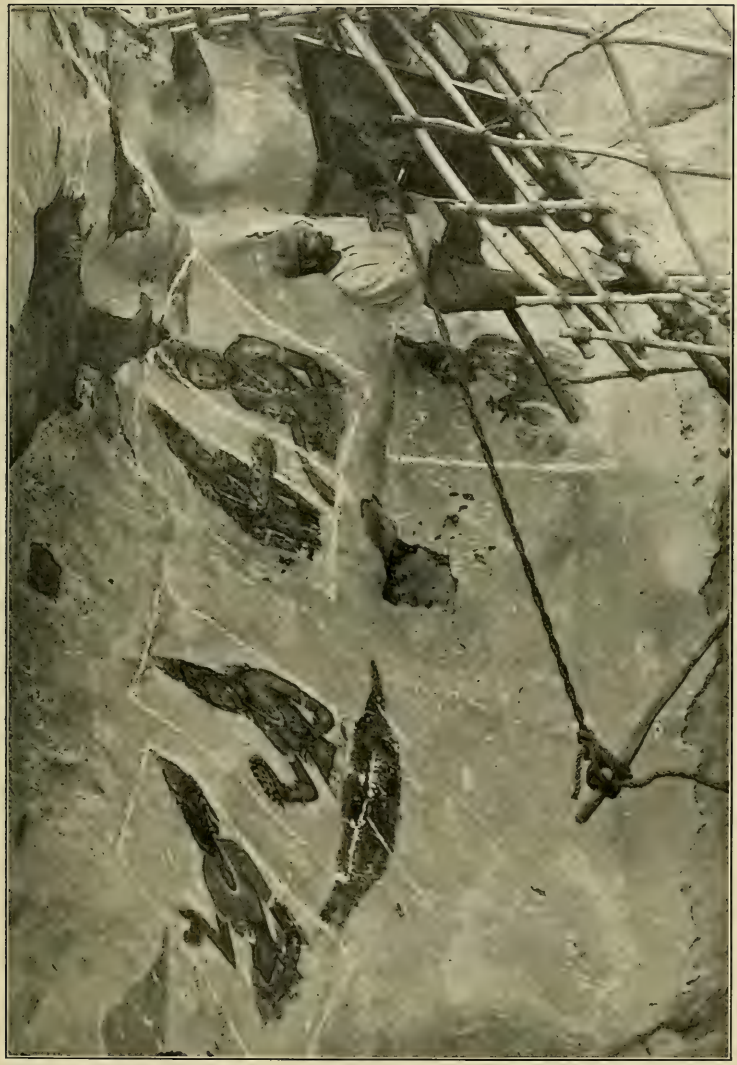
sonry crumbled and the splendor of Sigiri dwindled. When the plain was devastated and depopulated and the approaches had suffered some sudden and complete ruin, the priests abandoned the monastery in the air, and as the Mahawanso does not make any mention of this withdrawal, it is believed that it had been abandoned for all of six centuries when the archæologists began work. In three seasons they uncovered the rock and put in the scaling ladders and hand rails to make it accessible, and fought off swarms of bees with fire balls. They long had hopes of uncovering treasure in the palace ruins, and dug through débris beds fifty feet deep, hoping for some precious spoil; but the Malabar marauders or the departing priests had swept it clear of valuable things before the last staircase crumbled.

Perched on that pinnacle peak, overlooking half that north end of Ceylon, as it seemed, the air was fresh and cool in spite of the overhead sun, and the place was inspiring. When the descent began and one looked down and off into vistas of space and diminishing perspectives over each boot tip, all sense of exhilaration was gone. The archæologist skipped like a chamois and walked securely as a fly, in his rope-soled tennis shoes, over the dizzy rock slopes. He left the grooves and the hand rails to the strangers, who sat down on the rock and abjectly crawled, feet foremost—"swarmed," in fact—down, along the slanting, curving rim of the mushroom's top, gripping the rail with a drowning man's thoroughness.

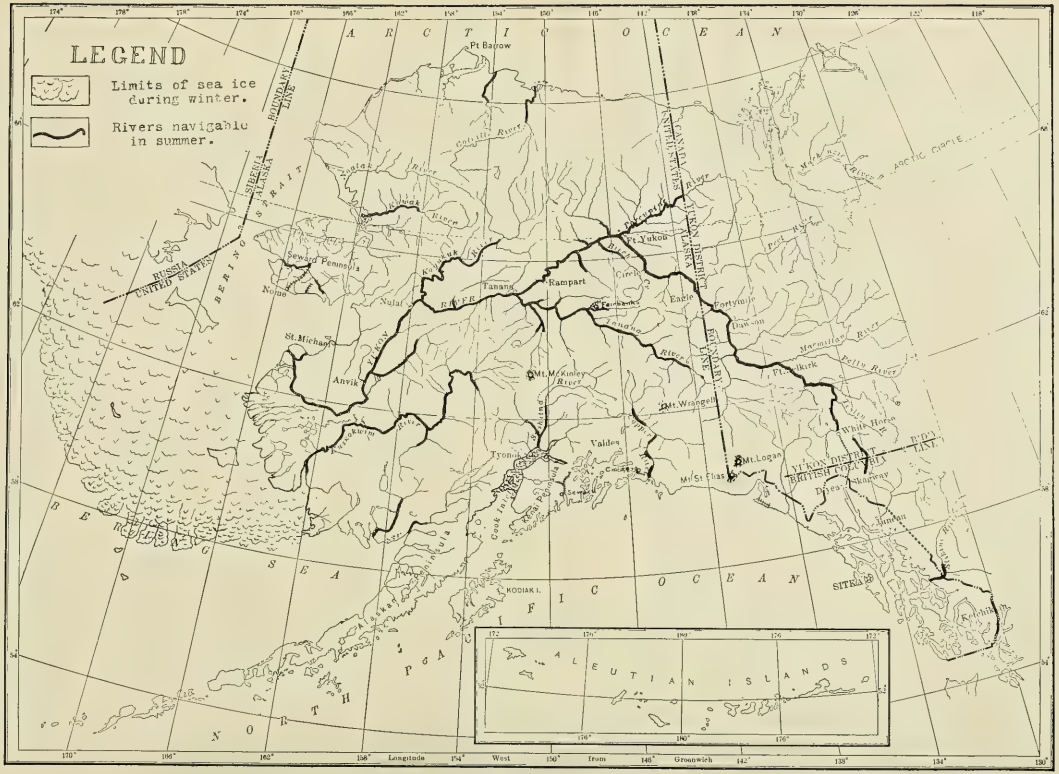
"No. We have not lost any tourists yet. None slipped off, none blown away, so far—and no suicides. Why, I often go up three and four times a day, to watch the work. It is quite safe. See?" and the archæologist side-stepped off on the perpendicular wall and danced a tarantelle with his own free foot flourished over six hundred feet of empty air, until we begged him to remember the future of archæology in Ceylon—a future that never can hold anything so unique and sensational as Sigiri.

The little Tamil horse boy sat on his heels flicking the noonday flies from the ponies when we reached the level lowland and its steaming, greenhouse atmosphere. He grinned at us, and we knew the black imp had seen our abject crawling on Sigiri heights.

"Did he go up?" and the coachman answered, "Yes; and it was very nice, he says, but the get-downing was awful. He has prayered and been saved."



Artist Copying Frescoes on the Rock Wall



Compiled by Alfred H. Brooks

Map of Alaska Showing Navigable Waters and Railroads

RAILWAY ROUTES IN ALASKA*

By Alfred H. Brooks

Geologist in Charge of Alaskan Division, U. S. Geological Survey

TRANSPORTATION is the first essential element to the industrial advancement of a new land. Therefore, though the subject of railway location may be of no great academic interest, there lies a justification for its discussion in the fact that it is of such vital importance to those who are developing the resources of Alaska. Moreover, the matter is timely because of its relation to a broad question of public policy, for many efforts have been made in recent years to obtain financial support from the federal government for Alaskan railway projects.

Popular interest in this subject appears to be only excelled by popular ignorance of it—an ignorance, too, which is constantly being augmented by misstatements in current literature. Some years ago the assertion was made in a magazine article that some parts of Alaska were being rapidly gridironed by railways. To those familiar with the primitive condition of transportation maintaining throughout the territory, such a statement can appear little short of ridiculous. This misleading article has, however, evidently been regarded as authoritative, for it has found place in a popular encyclopædia.

Though the aggregate mileage of railways in Alaska is less than 200, but little more than that of Porto Rico, this is divided among eight different lines. Of these, four are along the Pacific seaboard, three on the Seward Peninsula, and one in the Tanana Valley (see map, page 164). All of these railways have been built to supplement water transportation.

RAILWAY LOCATION

In the discussion to follow of the principles governing railway location, I will confine myself entirely to commercial lines, for obviously railways built for military or scenic purposes will follow routes determined by entirely different conditions.

The controlling factors of railway location fall into two important groups, here termed (1) commercial and (2) geographic, while in regions lying close to international boundaries a third, namely, political, becomes operative. Each of the first two groups resolves itself into several subordinate factors, one or more of which may dominate in any given province, to the practical exclusion of all the others. The following table is an attempt to present a terse analysis of the problem of railway location:

I. *Commercial control:*
   1. Developed resources (statistics of production and commerce).
   2. Undeveloped resources.
      Mineral (economic geology).
      Agricultural (climate, soils, and botany).
      Timber (distribution, quality, and quantity).
   3. Population.
   4. Competitive or supplementary lines of transportation (navigable waters and existing railways).

II. *Geographic control:*
   1. Position (terminals and connecting lines of transportation).
   2. Distances (comparison of distances of different routes).
   3. Relief (mountain ranges, passes, and valleys, as affecting gradients).
   4. Water-courses (depths and width of rivers, as affecting construction of bridges or ferries).
   5. Climate (precipitation, etc., as affecting cost of construction, operation, and maintenance).

III. *Political control:*
   1. Political boundaries.

Before analyzing this table I will forestall possible criticism by stating that certain elements which must of necessity

* Published by permission of the Director of the United States Geological Survey. Read at the third annual meeting of the Association of American Geographers, New York, January 1, 1907.

have an important influence with a locating engineer are here entirely omitted because they do not appear to be germane to the subject. In this I refer more specially to the financial backing to any given project. Obviously the choice of a railway route may have to be governed by the low cost of first construction rather than by consideration of the ultimate economy in construction, operation, and maintenance. I believe, however, that the question of financing of a railway project should find no place in a scientific discussion of railway location. The available sources of material for construction have also not been included in this analysis, for this is, after all, a local problem and will not affect the general choice of routes.

COST PER MILE

Though it is not the purpose of this paper to discuss the more purely engineering aspect of my subject, yet it may be well to devote a few words to the question of the cost of construction because of the many current misconceptions regarding it. It will be pointed out below that the watersheds to be crossed by Alaskan railways (see profiles, page 179) vary from about 2,000 to 3,000 feet, which are low compared with the altitudes of 8,000 to 11,000 feet attained by many railways in the western states. It will also be shown that the routes of approach to the divides have as a rule low gradients, and that much of the region to be traversed by railways is one of only moderate relief. On the other hand, most of the proposed routes will demand bridging of many streams and rivers. This feature will possibly be the most difficult for the engineer to contend with, because of (1) the winter ice and (2) the spring floods.

The chief factor which will much enhance the expenditures for railway construction in Alaska is the distance of the coastal terminal to the centers of population, for this increases the cost of all labor and materials. Shortness of the summer season and adverse climatic conditions will also enhance the cost. It has been estimated by a competent engineer that the same class of construction will cost 75 to 100 per cent more in Alaska than in the western states. The same engineer has stated to the writer that in many parts of the interior, where valleys and rolling uplands are followed, the cost of a standard-gauge railway will probably not exceed $30,000 per mile, but through the coastal mountain ranges may be more than twice as great. Where detailed surveys and estimates are wanting, it will probably be safe to count on an average cost of at least $35,000 per mile for a standard-gauge railway from the Gulf of Alaska to the Yukon.

What I have termed commercial control is simply another name for tonnage, the great dominating element in railway location. This, in turn, is dependent in a large measure on resources, developed or undeveloped. In settled regions the distribution of population may wield a decided influence, but population again is often merely an evidence of developed resources. The amount of tonnage will also be affected by competitive and supplementary lines of transportation.

Five subdivisions are recognized under geographic control. The first is position, which pertains chiefly to location and character of terminals and their relation to other transportation systems. Under the second, distances, the different routes are compared in length. Under relief is included the influence of topography, while larger water-courses must be considered because they necessitate bridges or ferries. The influence of climate on cost of construction, operation, and maintenance is obvious. Heavy snowfalls, river floods, and the closing of waterways by winter ice are elements that deserve consideration. Political control obviously refers to international boundaries alone.

I have intentionally emphasized the commercial control of railway routes, for it is evident that without adequate tonnage railways cannot be built economically. On the other hand, given the re-

sources to warrant the cost of construction and operation, and the modern engineer will build a railway almost anywhere. In this I do not intend to indorse the policy, too often followed, of railway location which is not preceded by comprehensive geographic investigation. Many railways have been based on routes chosen by the old adage: "The Indian followed the buffalo, the white man the Indian, and the locomotive the white man." As a consequence, nearly every transcontinental line has made or is contemplating changes of routes involving the expenditure of millions of dollars which might have been avoided by proper exploration and survey. The lesson has not yet been learned, however, for recently a corporation proposing to build a railway in Alaska, after spending several hundred thousand dollars in construction, abandoned the chosen route for another. In this case a tenth part of the money spent on what proved to be worthless construction would have more than paid for the necessary explorations and surveys.

It follows from the above that while the demand for transportation between certain localities may be such that a railway will be built in spite of the physical obstacles, yet economic location demands the most careful adjustment to the topography.

RESOURCES TO BE DEVELOPED

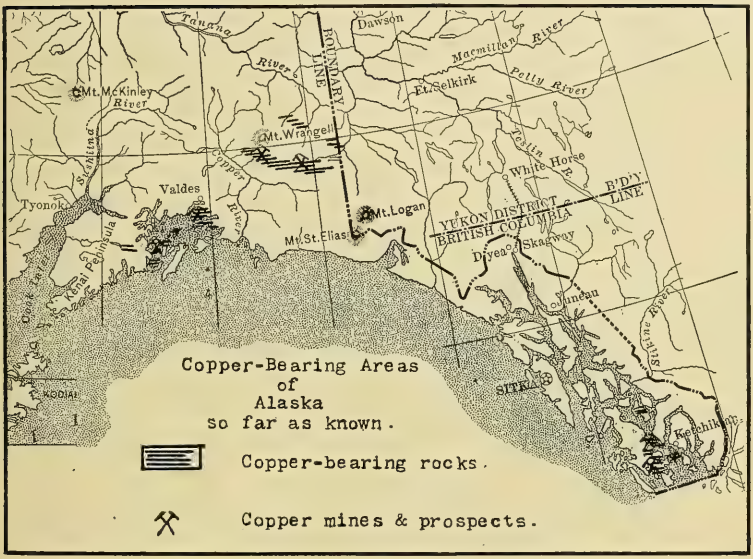
It is evident that a discussion of railway routes must consider the resources of the territory as well as its physical features; that is, on one hand, the possibilities of traffic must be discussed; on the other, the routes of approach. The question of traffic again resolves itself into statistics of existing commerce and the foreshadowing of that to come from undeveloped resources.

In Alaska the problem is simplified by the fact that the immediately available resources to be developed by railway construction are all of a mineral character. I do not by this mean to decry the agricultural possibilities of certain parts of the territory, but I do believe that these may be almost neglected in the present discussion, for the reason that these arable lands are too remote from centers of population to yet compete with the more accessible and fertile lands in the states. The capitalists will certainly look to the mines of precious metals and of coal to recoup themselves for outlays on railway construction. With the mining development some agricultural progress will unquestionably be made and eventually be a source of traffic for the road. There is no timber for export except along the Pacific seaboard (see page 183). In fact, much lumber is annually taken into the interior, and this consumption is likely to become greater, if the present ravages by forest fires in the Yukon Basin continue.

The discussion of resources to be developed by railways, therefore, resolves itself into a consideration of the mineral wealth and its distribution. In other words, it is a geologic problem. Though the basal facts are very incomplete, yet some salient features of the economic geology are known, and these bear directly on the problem of mineral resources. It is not my purpose to describe the geology of the territory, but I will call your attention to the distribution of certain terranes which carry minerals of economic value. The rocks grouped together as undifferentiated Paleozoic, including the gold-bearing horizons, occur in three belts, one running parallel to the Pacific seaboard, a second lying centrally in the Yukon Province, and a third forming the country rock of the major part of the Seward Peninsula (see map, page 168). Of the $100,000,000 which represents in round numbers the total mineral production of Alaska, over 98 per cent has been taken from areas underlain by these rocks. In southeastern Alaska there is a well-defined contact between a broad belt of intrusives and these metamorphic terranes, and this has been proved to be the general locus of auriferous lodes. It should be noted that the northern extension of this contact lies in

Compiled by Alfred H. Brooks

Map of Alaska, Showing, so Far as Known, the Distribution of Metamorphic Rocks, and the Localities where Gold Has Been Mined



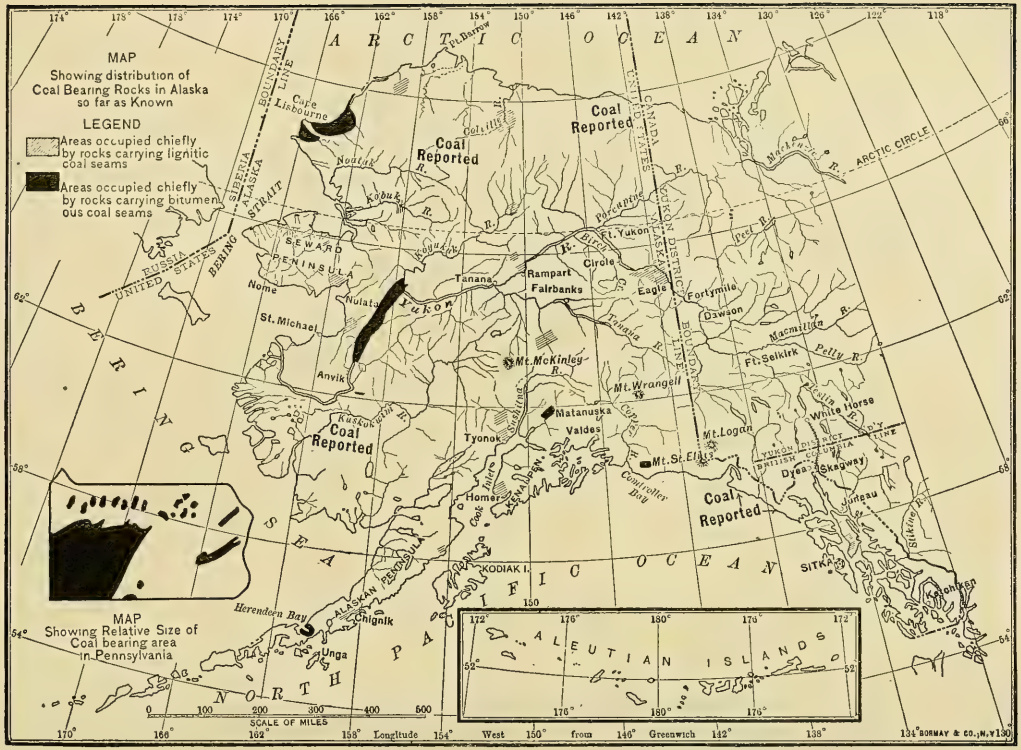
a little-known region, as will be shown later; it is close to one of the proposed railway routes into the interior. Another fact bearing on the mineral resources can be interpreted in terms of geology. On either side of the Wrangell Mountains is a belt of Devonian rocks which are copper-bearing (see map, page 169). These are, indeed, the outcrops of the same terrane along two areas of a syncline and form the objective points of several railway projects.

The map on page 168 shows the distribution of the auriferous terranes of the territory so far as determined. It emphasizes the fact that there is an extensive gold-bearing area lying well within the heart of the territory and 400 to 500 miles from tidewater.

COAL AND COPPER

The total area of the known coal-bearing rocks in Alaska is approximately 12,000 square miles (see map, page 170). Unfortunately, much of the coal in the northern province is of a lignitic character, and though it will eventually find local use, cannot now be regarded as an important source of tonnage for railways. There are two coal fields, however, the Controller Bay and Matanuska, aggregating at least 120 square miles, which carry high-grade bituminous and some semi-anthracite coal. This coal is superior to any mined on the Pacific seaboard of the continent and is suitable for metallurgical purposes. Both fields are objective points of railways now under construction and are expected to furnish local tonnage for these roads, to be eventually extended into the interior. Bituminous coals also occur on the Yukon and at Cape Lisburne, on the Arctic Ocean.

Only the copper deposits of the inland region are important to this discussion, and these include two different districts lying north and south of the Wrangell Mountains, on the two arms of a syncline



Compiled by Alfred H. Brooks

Map of Alaska Showing the Distribution of the Coal-bearing Rocks so Far as Known

(see map, page 169). The southern belt, to which a railway is being built, has been sufficiently developed to indicate a large tonnage.

AGRICULTURAL POSSIBILITIES

I have shown that the resources which promise to yield a tonnage are gold, copper, and coal. The forests, except along the seaboard, have no value for export (see map, page 172). Inland the heavy timber, of which the largest trees are not over two feet in diameter, is closely limited to the river courses. Though there are sawmills in every placer camp of the Yukon, that these do not even supply the local demand is made evident by the fact that in 1905 upward of $30,000 worth of lumber was brought to the Yukon from Puget Sound. The timber map can also be used to indicate the general distribution of arable lands, for the areas marked as timber embrace practically all the lands which may possess future agricultural value. A region lying adjacent to and north of Cook Inlet appears to be best adapted for agriculture, but in the Copper and Tanana basins, too, there are considerable tracts of agricultural and grazing lands. It should be borne in mind that beyond the coastal barrier the subsoil usually remains perpetually frozen and the climate is semi-arid. These conditions, combined with the shortness of the growing season and the liability of frosts, do not invite agricultural pursuits. Nevertheless, the conditions are no more adverse than those existing in some European countries which support a thrifty agricultural peasantry and export agricultural products. The richness of the soil is attested by the many gardens found throughout the inland region. These are specially successful where hot springs have thawed the soil. One of these is shown in the illustration on page 183.

4 TONS OF COAL AND 30 TONS OF GOLD EXPORTED IN 1905

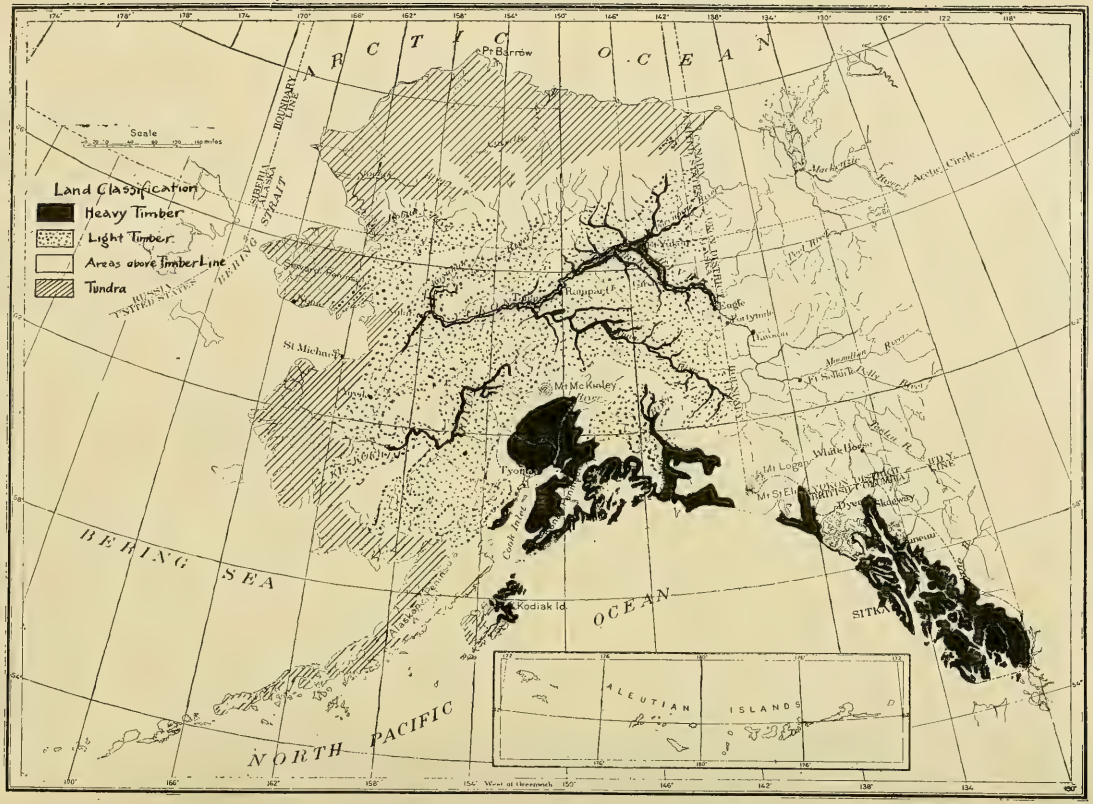
As regards the developed resources, little can be added to what has already been presented. The rapid increase in gold production is shown in the diagram on page 175. Including 1906, the total output of gold is about $100,000,000, only about one-quarter of which has come from the inland districts, as shown in the following table:

Gold Production of Alaska, with Approximate Distribution

Year.	Pacific coastal belt.	Copper River and Cook Inlet region.	Yukon Basin.	Seward Peninsula.	Total.
1880....	$20,000	.....	.....	.....	$20,000
1881....	40,000	.....	.....	.....	40,000
1882....	150,000	.....	.....	.....	150,000
1883....	30,000	.....	$1,000	.....	301,000
1884....	200,000	.....	1,000	.....	201,000
1885....	275,000	.....	25,000	.....	300,000
1886....	416,000	.....	30,000	.....	446,000
1887....	645,000	.....	30,000	.....	675,000
1888....	815,000	.....	35,000	.....	850,000
1889....	860,000	.....	40,000	.....	900,000
1890....	712,000	.....	50,000	.....	762,000
1891....	800,000	.....	100,000	.....	900,000
1892....	970,000	.....	110,000	.....	1,080,000
1893....	838,000	.....	200,000	.....	1,038,000
1894....	882,000	.....	400,000	.....	1,282,000
1895....	1,569,500	$50,000	709,000	.....	2,328,500
1896....	1,941,000	120,000	800,000	.....	2,861,000
1897....	1,799,500	175,000	450,000	$15,000	2,439,500
1898....	1,892,000	150,000	400,000	75,000	2,517,000
1899....	2,152,000	150,000	500,000	2,800,000	5,602,000
1900....	2,606,000	160,000	650,000	4,750,000	8,166,000
1901....	2,072,000	180,000	550,000	4,130,700	6,932,700
1902	2,546,600	375,000	800,000	4,561,800	8,283,400
1903....	2,843,000	375,000	1,000,000	4,465,600	8,683,600
1904....	3,195,800	500,000	1,300,000	4,164,600	9,160,400
1905....	3,430,000	500,000	6,900,000	4,800,000	15,630,000
1906....	3,500,000	400,000	10,000,000	7,300,000	*21,200,000
Total.	37,470,400	3,135,000	25,081,000	37,062,700	102,749,100

*Production for 1906 is estimated.

The copper production, which in 1905 was valued at $750,000, has so far been only from the coastal zone, and therefore does not affect this discussion. In 1905 4 tons of coal were exported from Alaska, as compared with 30 tons of gold, which strikingly indicates that the coal fields have not yet been exploited. Several thousand tons are, however, mined annually for local use. It is worthy of note that both the Controller Bay and Matanuska coal fields (see map, page 170) carry some excellent coking coals, and, if made accessible by railways, the mining of this character of fuel for smelting of the copper ores is likely to become an important industry.



Map of Alaska, Showing Distribution of Timber

Compiled by Alfred H. Brooks

The custom-house statistics show that $3,272,411 worth of goods were carried to the Alaska Yukon from the United States in 1905, which probably represents between 15 and 20 thousand tons of freight. The cost of the freight on this tonnage amounted probably to over $1,200,000 to the consumer. This sum, allowing three-quarters for operating expenses, would pay probably 5 per cent interest on the cost of constructing 200 miles of railway, or half the distance from tide-water to the Yukon placer camps. I call attention to this to show that, even with the present condition of development, railway projects are not entirely visionary.

The important mineral-bearing area of Alaska falls into four provinces, most of which are undergoing rapid development (see map, page 181). These are (1) the Pacific littoral, (2) the Seward Peninsula, (3) the Sushitna-Copper River province, and (4) the Yukon-Tanana region. The Pacific littoral lies for the most part on tide-water (see map, page 164), open throughout the year, and needs no railway system to develop it, though there are many places where short lines will eventually be built. The Seward Peninsula, which in 1906 produced about $7,300,000 worth of gold, is accessible to ocean-going vessels for fully a third of the year. These, with the 100 miles of railway already in operation and other projected lines, afford means of communication which, while it leaves much to be desired, yet is sufficient to enable large mining operations to be carried on.

THE NEW YORK TO PARIS RAILWAY

Plans for the construction of the so-called New York to Paris Railway, across Alaska and Siberia, have found some earnest advocates during the past few years. Though this project rather falls outside of the present discussion, yet it deserves mention, if for no other reason than for the publicity it has received. Alaska can obviously not be connected with the United States by rail except by a line through Canadian territory (see map, page 176). When the new Canadian transcontinental railway, known as the Grand Trunk Pacific, which is to reach to the Pacific coast in latitude 54°, is completed, a branch could be extended northward, which could reach Fairbanks with 800 to 1,000 miles of track. While such a line would not encounter any serious obstacles, yet many watersheds would have to be crossed, and as it would run transverse to the larger drainage channels, there would be heavy expense for bridges. A railway from Fairbanks to Cape Prince of Wales would require at least 600 miles of track. It is proposed to tunnel Bering Strait, which is 54 miles from headland to headland, but is broken by the Diomede Islands, lying about half way between (see map, page 176). While tunnels of the length required are probably not an impossible engineering feat, they are so far beyond anything of the kind as yet attempted that it must be a bold group of capitalists who would undertake it. Ferriage across the strait, difficult in summer because of the strong northerly setting current, is impossible during seven or eight months in the year because of the ice floes. As the strait seldom freezes over, communication without a tunnel would be entirely interrupted.

This intercontinental railway project, divested of its glittering generalities, amounts to this: The first 1,000 miles of track would parallel the Pacific seaboard and reach a point less than 500 miles distant from tide-water by a more direct route. An additional 600 miles of track would be needed to reach Bering Strait, and this, too, would be in direct competition with deep-water navigation for at least a third of each year. Furthermore, to connect the two sides of the strait, as proposed, would require two tunnels more than twice as long as any hitherto constructed. The Siberian part of the route would appear to have even less justification, for here 1,500 to 2,000 miles of unsettled and unproductive territory would have to be traversed.

URGENT NEED OF RAILWAYS IN COPPER RIVER DISTRICT

Whatever the future may bring forth leading to a demand for railway connection with Seward Peninsula, it is certain that there is at the present moment an urgent need for railways between the Gulf of Alaska and the inland region lying to the north. Only by such railways can the copper and gold deposits of the Sushitna and Copper rivers and the placer fields of the Yukon reach their full development. Here is an area about 400 miles square, bounded on the east by the international boundary, on the north by the Arctic Circle, on the west by the 154th meridian, and on the south by the Pacific, which contains, as has been shown, valuable copper deposits, the best of the known Alaskan coal fields, as well as extensive areas of auriferous gravels. Good grass land is abundant and cattle-raising can probably be profitably carried on to supply the local market, which is sure to arise with mining developments. The agricultural values, though of interest to the economist, will probably be disregarded by the capitalist, who will look to the development of mines for returns on his venture. Certainly without the ore and coal deposits there would be no railways, and without these there will be no agriculture until more accessible regions are settled.

Though now the annual mineral output of this province is only about $10,000,000 in gold, there appear to be great possibilities in the way of mining developments, provided it can be made accessible to commerce.

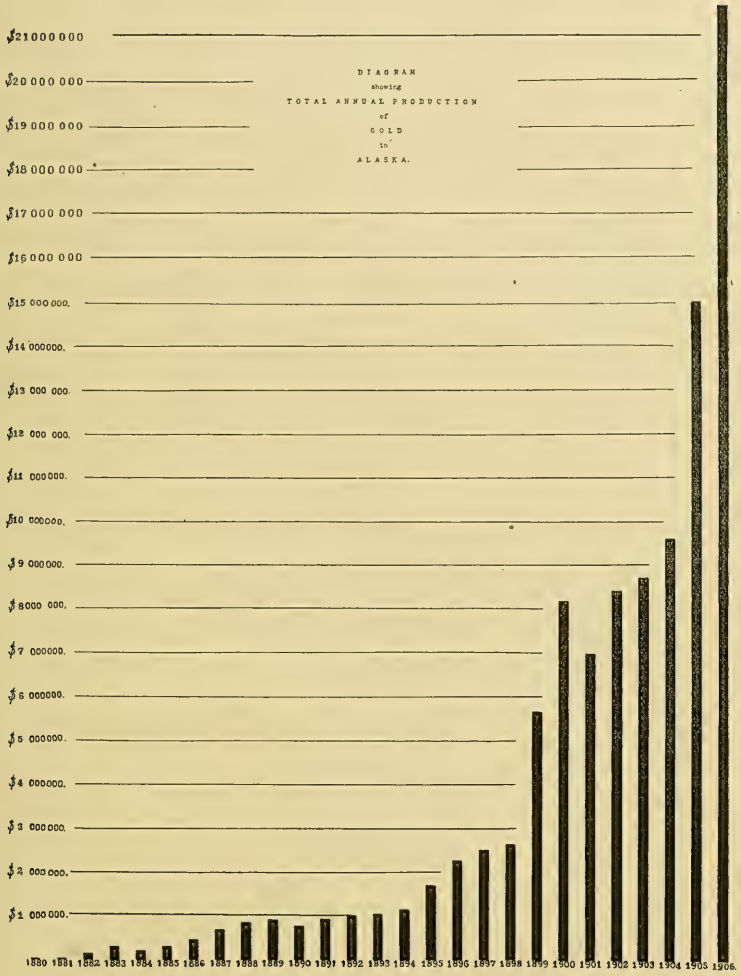
The mining districts of the Sushitna-Copper River province are only accessible by an overland journey of 100 to 300 miles, for the rivers which empty into the Pacific are for the most part torrential in character and but few are navigable. All the supplies for these districts have to be sledded in during the winter months, at a cost of 10 to 20 cents a pound. The charges for summer transportation by pack-horse are from 30 cents to a dollar a pound.

PRESENT LONG WATER-ROUTE TO FAIRBANKS DISTRICT

In the Yukon Basin conditions are somewhat more favorable, because of the extensive system of navigable waters (see map, page 164). Before the freight reaches the Yukon, however, it has to make a circuitous route to the mouth of the river, open to navigation only from the end of June to September. During summer months Yukon River steamers can deliver freight to points 20 to 100 miles distant from the placer districts. This freight must await the winter snow before it can be finally sledded to its destination, unless the summer charges of 20 to 25 cents a pound are to be paid. Under these conditions, freight which is moved by the cheapest form of transportation (by steamer in summer and sleds in winter) costs the miner from 5 to 10 cents a pound, delivered at his mine. Translated into terms more familiar to the average man, this means that the mine operator may have to pay a rate on all his heavy machinery equivalent to the charges for express between New York and San Francisco. In fact, I have known mining enterprises to be carried on in localities to which the transportation charges were greater than letter-rate postage. Under such conditions it is evident only deposits of extraordinary richness can be exploited, and that most extensive mining operations must await the reduction of costs that can be brought about only by the construction of a railway.

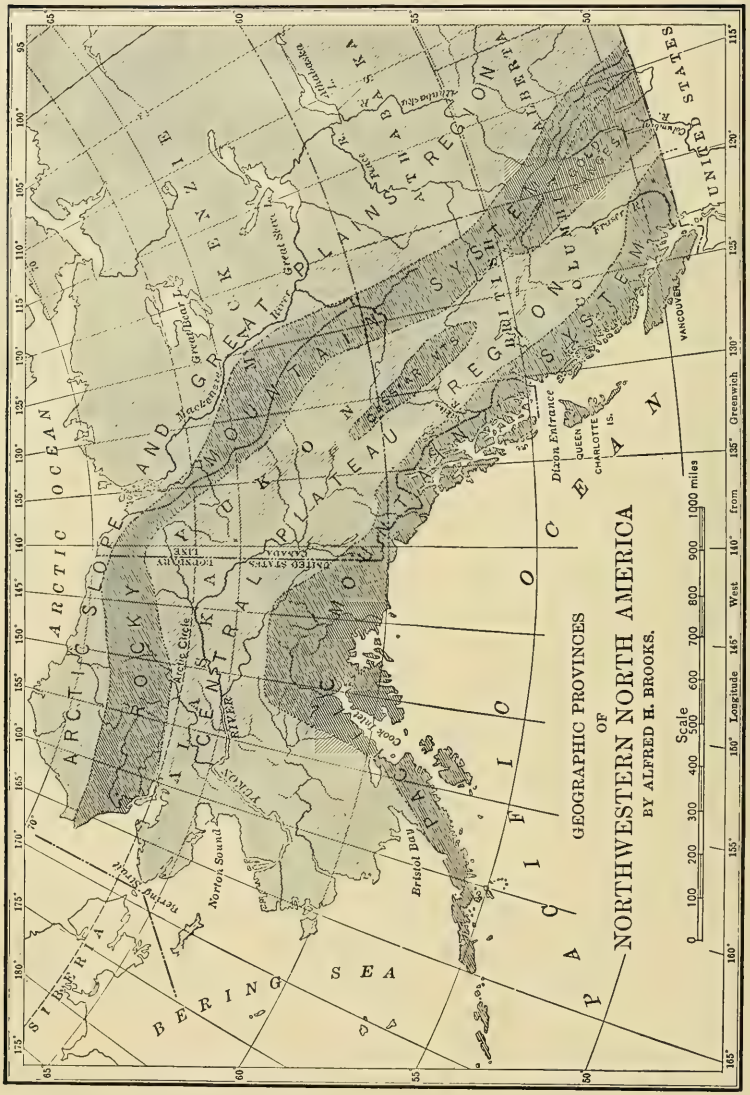
GEOGRAPHIC CONTROL

Having set forth the facts which go to indicate that the resources of central Alaska are sufficient to warrant the construction of a railway, it is in order to consider the question of geographic control of routes. It has been shown that the present demand for transportation facilities is in the province lying between the international boundary and the 154th meridian, and this district will here alone be considered. The rugged mountain mass skirting Alaska's southern border



Annual Production of Gold in Alaska Since 1880

The total amount is considerably over $100,000,000


GEOGRAPHIC PROVINCES
OF
NORTHWESTERN NORTH AMERICA
BY ALFRED H. BROOKS.
Scale
0 100 200 300 400 500 600 700 800 900 1000 miles
ARCTIC OCEAN
BERING SEA
PACIFIC OCEAN
ARCTIC SLOPE AND GREAT PLAINS REGION
ROCKY MOUNTAIN SYSTEM
ALASKA RANGE
ALEUTIAN REGION
YUKON REGION
COAST MOUNTAINS
COLUMBIA SYSTEM
INTERIOR PLATEAU
PACIFIC MOUNTAIN SYSTEM
ALASKA
CANADA
UNITED STATES
Mackenzie R.
Great Slave L.
Great Bear L.
Athabasca R.
Peace R.
Yukon R.
Kuskokwim R.
Arctic Circle
Bering Strait
Norton Sound
Cook Inlet
Bristol Bay
Dixon Entrance
Queen Charlotte Is.
Vancouver
Greenwich
from
West
Longitude

presents a serious barrier to inland travel (see plate, page 184). This zone, including a number of parallel ranges forming the Pacific Mountain system of Alaska, but 50 miles in width at Lynn Canal, broadens out to the northwest, and at Cook Inlet attains a width of over 200 miles. Inland of this system lies another province of far less relief, which has been termed the Central Plateau region (see map, page 176). The drainage of this central region is carried, for the most part, to Bering Sea through the Yukon River, while the waters of the Pacific Mountain province flow southward and through the Chilkat, Copper, Susitna, and smaller rivers to the Pacific. One river alone, the Alsek, finds its source in the Central Plateau region, and traverses that entire Pacific Mountain system on its way to the sea. Obviously the valley of the Alsek is from a topographic standpoint the only logical railway route into the interior. It will be shown, however, that the commercial and political factors are so adverse in case of the Alsek Valley as to appear to rule it out.

Besides the valleys of the larger rivers, already mentioned as flowing into the Pacific, there are a number of low passes breaking through the mountain barriers. Among the most important for the present discussion are the White Pass (2,800 feet), a break in the Coast Range north of Lynn Canal, across which a railway has already been built. At the head of the Chilkat River, whose valley separates the Coast and Saint Elias ranges, there is an unnamed pass about 3,100 feet high (see profiles, page 179). West of Lynn Canal the coastal range represents an almost unbroken front, except for the Alsek and Copper River valleys. At the inland front of the Saint Elias Range the Alsek Valley has an altitude of about 2,000 feet, and is connected with the drainage basin of the White River to the west by a pass but 2,400 feet high.

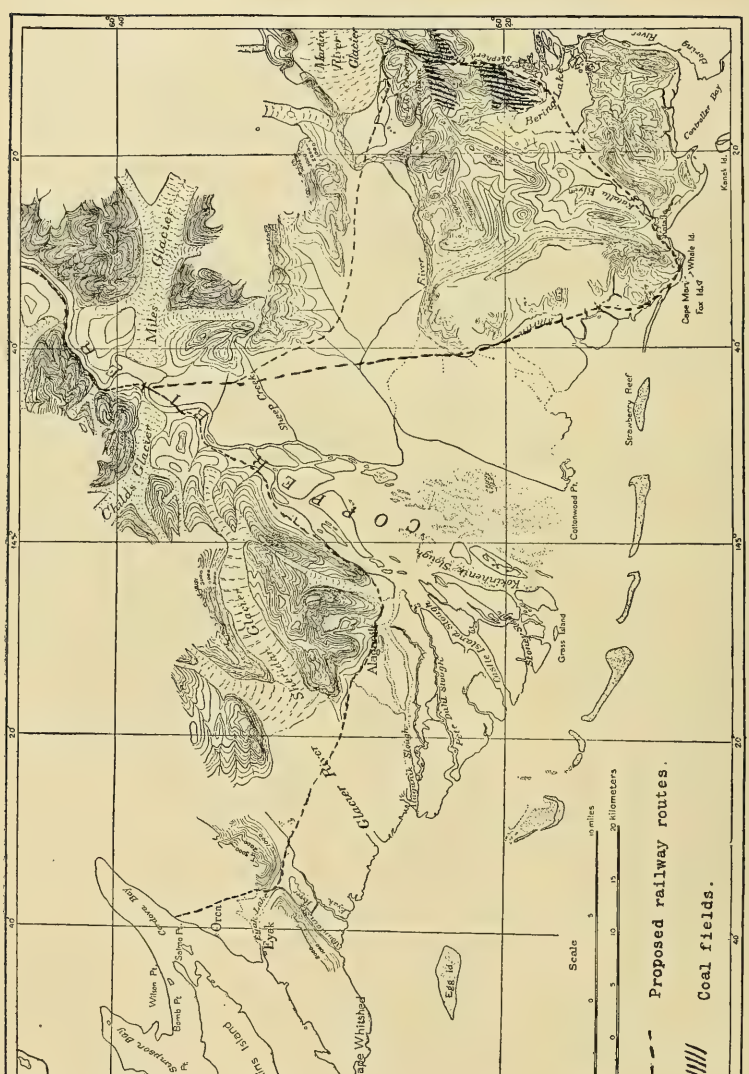
Low River, which empties into Valdez Inlet of Prince William Sound, is separated from the Copper River by Marshall Pass, about 1,900 feet high. At the head of the Copper there are several passes leading into the Tanana Valley, of which the lowest is called Mentasta (3,000 feet), and the next, which is unnamed, connects the Gulkana and Delta valleys. Both of these passes are through the eastern end of the Alaska Range, and one or the other will be used by any railway built from the Copper Basin into the Tanana Valley.

It will be evident from the matter presented that commercial control limits the choice of inland railway routes to the region lying between Lynn Canal on the east and Cook Inlet on the west (see map, page 181). Topographic control, furthermore, limits the choice to four general zones, which may be named after the chief rivers, whose valleys determine the location. These are named from south to north: (1) the Chilkat basin, (2) the Alsek basin, (3) the Copper basin, and (4) the Susitna basin.

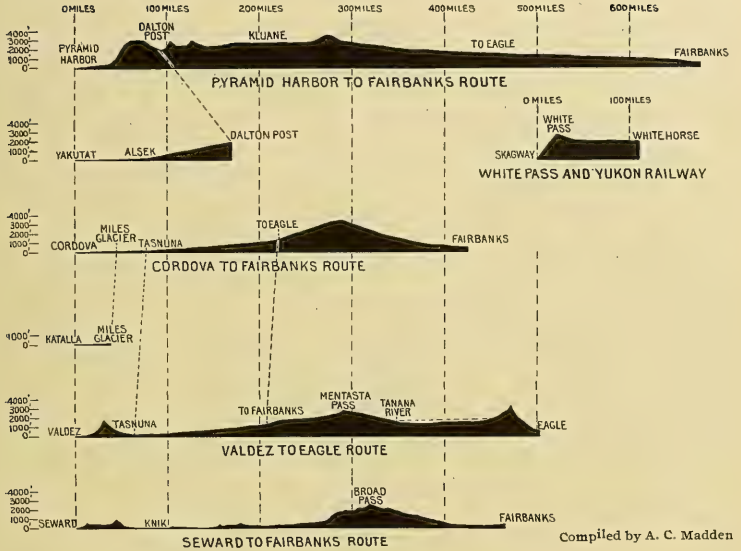
The first requisite for an inland railway from the Gulf of Alaska is an adequate coastal terminal. This means not only a deep-water harbor, but also opportunity for construction of wharfs, as well as a townsite near at hand. Other desirable, though not absolutely necessary, conditions are available timber, water power, and a favorable climate. If possible, the harbor should be accessible to sailing as well as steam vessels, and the routes of approach should be devoid of dangers to navigation; but, beside all these desirable attributes, the distance of the coastal terminal to the points of shipment on the west coast of the United States is of first importance.

HARBORS

The recent geological history of the Pacific shore-line of Alaska is favorable to the formation of harbors, for it is a glaciated region, and, as many have shown, glaciation produces fiorded coast lines. This is, however, only true where sedimentation subsequent to glaciation has not silted up and smoothed out the coast line. The first condition prevails



Topographic Reconnaissance Map from Controller Bay to Prince William Sound



Generalized Profiles of Proposed Railway Routes

in southeastern Alaska and on Prince William Sound, where the coast is characterized by deep fiords with many tributary embayments (see map, page 176). In the intervening region the retreat of the larger ice-sheet left many large glaciers on the coastal slope of the Saint Elias Range and in the Piedmont belt, and these, having access to bed rock along their margins, have contributed a large amount of sediment. This sediment has been deposited as extra-glacial material and has buried much of the fiorded coast line. Therefore the physiographic features make southeastern Alaska or Prince William Sound the most favored locality for coastal terminals.

Other factors have to be considered. Lynn Canal is a superb deep waterway, but its funnel shape causes it to be subject to severe wind-storms, and it is therefore not favorable for sailing vessels. The same holds true, in a less degree, of the upper part of Prince William Sound. Resurrection Bay, which penetrates the mainland to a much shorter distance, affords an almost ideal harbor. Though the shore-line between southeastern Alaska and Prince William Sound is not favorable for harbors, yet two indentations, Yakutat Bay and Controller Bay, furnish some protection for vessels (see map, page 178).

In the comparison of distances it will be convenient to use Puget Sound as a reference point (see map, page 176). Lynn Canal is less than 1,000 miles (statute) from Puget Sound, as compared with 1,150 for Yakutat Bay, 1,350 for Cordova Bay, 1,400 for Valdez Inlet and Resurrection Bay. The route to Lynn Canal is by an intricate and somewhat dangerous inland waterway, and the

actual time consumed in the voyage is not very much greater to the western harbors than to Lynn Canal. As regards climate, there is little to choose between the various coastal terminals. Throughout the Pacific seaboard there is a heavy precipitation, varying from about 90 inches on Lynn Canal to about 125 inches in Prince William Sound. Heavy storms are usually from the southwest, and more commonly occur from October until May. As soon as the mountains are entered, very heavy snowfalls are to be expected. The coastal belt is usually heavily forested with timber which can be used in construction.

It remains to describe the individual routes and compare their respective advantages. For this purpose the general location of the different routes has been indicated on the map (see page 181), together with their relation to the mountain barriers and to the distribution of the known mineral resources. Profiles (page 179) have also been constructed of the more important projects, and these have been grouped together for purposes of comparison. It should be distinctly stated, that while in the construction of these profiles the best available data has been assembled, yet this is so incomplete that the results must be regarded as an approximation. Many of the distances and altitudes here presented will undoubtedly be found inaccurate when detailed surveys are made.

PYRAMID HARBOR, TANANA RIVER

Chilkat River debouches into a western arm of Lynn Canal, called "Pyramid Harbor," and its valley separates the Saint Elias Range on the west from the Coast Range on the east. A broad pass about 3,000 feet high, 50 miles from the coast, separates its headwaters from inland-flowing streams. Beyond this pass the route would enter the Alsek basin and follow the inland front of the Saint Elias Range. Two forks of the Alsek will have to be crossed, but present no serious engineering difficulties. A series of depressions, part of a system of abandoned valleys, affords an ideal railway route beyond the west fork of the Alsek. The route would probably skirt the south shore of Lake Kluane 2,400 feet above sea-level and enter the White River Valley near the international boundary. After crossing White River at the canyon the line would be extended through a broad, flat depression to the Tanana Valley, which would be followed to Fairbanks. As indicated in the profile, there are no very heavy grades to be overcome in this route. Branch lines could be built to the copper deposits of the White River and to the Fortymile, Birch Creek, and Rampart placer districts.

Pyramid Harbor, which affords shelter for vessels and opportunities for wharf construction, can be reached by a 1,000-mile journey from Puget Sound, entirely within sheltered waterways. The Chilkat basin is well timbered (chiefly spruce and hemlock) (see map, page 172) and contains some auriferous gravels, though the producing district lies somewhat off the proposed railway route. The copper deposits of Rainy Hollow, which are undeveloped, lie about 20 miles off the main route. In the inland region there are no developed mineral resources except a small placer district. However, the meager knowledge of the geology indicates that there may be here a continuation of the mineralized belt of southeastern Alaska, and that workable ore deposits may yet be found.

There can be no doubt that this is a natural route into the interior, and it was long used by the natives in their intertribal intercourse. It has one grave disadvantage, namely, that for about 300 miles it traverses Canadian territory, and would therefore not afford an all-Alaskan route. Under the custom laws, international railways are always at a disadvantage. Moreover, it would not help to develop the resources of the Copper River and Sushitna River basins.

YAKUTAT BAY-ALSEK-TANANA RIVER ROUTE

The lower Alsek River valley, which is transversed to the Saint Elias range, affords a possible route into the interior.

Compiled by Alfred H. Brooks

Map of Alaska, Showing Railway Routes and Known Occurrences of Economically Important Minerals

The line would run southeastward from Yakutat Bay for about 50 miles, to the mouth of the Alsek. A narrow-gauge railway has already been built for about 10 miles of this distance, for the purpose of bringing fish to the salmon cannery at Yakutat. The Alsek Valley is almost unexplored, but no doubt a railway could be built through it. It would intersect the Pyramid Harbor-Tanana route about 200 miles from the coast, and would there attain an altitude of about 2,400 feet (see profile, page 179).

Yakutat Bay, which is about 1,150 statute miles (1,000 nautical miles) by sea from Puget Sound, is only a fair harbor, and, so far as known, the proposed railway would not tap any mineral deposits, though such may exist in the unexplored Saint Elias Mountains. At 170 miles from Yakutat it joins the Pyramid Harbor route, and is open to the same objection, inasmuch as it passes through Canadian territory.

CORDOVA BAY, OR CONTROLLER BAY, COPPER RIVER

Cordova Bay, an eastern arm of Prince William Sound, lies about 30 miles west of Copper River. A railway, now in construction, is to follow a route skirting the coastal margin of the mountains to the Copper River, and then, turning northward, to traverse the Chugach Mountains through the valley of that river. A distance of about 200 miles will bring it to the mouth of the Chitina, and with 100 miles more of track it will be able to tap the copper belt, which skirts the southern margin of the Wrangell Mountains. The route to the mouth of the Chitina follows the river grade, and there are no serious engineering difficulties, with the exception of the two bridges, 800 and 1,200 feet in length, which will have to be built across the Copper to avoid the Miles and Childs glaciers (see illustration, page 190).

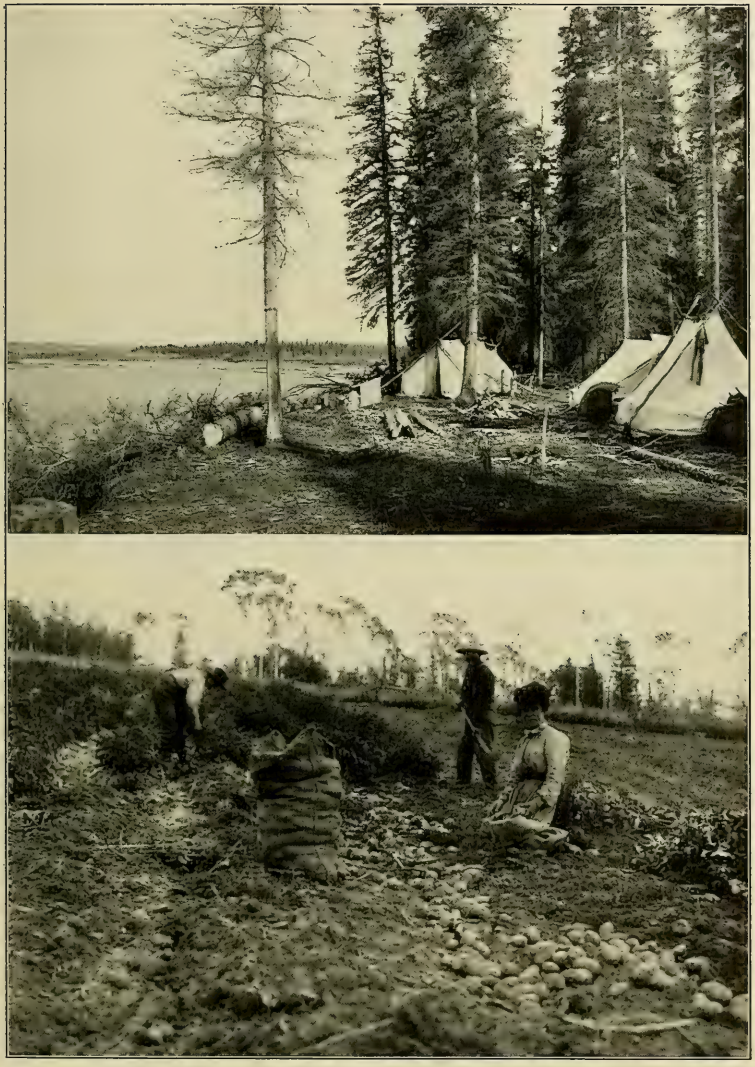
A corollary to this plan is to construct a branch line about 35 miles in length from the Copper River to the Controller Bay coal field (see map, page 178).

A rival company has made a survey for a railway from near the mouth of Katalla River, 30 miles east of the Copper, which is to run northwestward to the head of the Copper River delta. A single bridge will be needed to avoid the glaciers, beyond which point the route will coincide with the one above described. This route has the advantage of the one above described, inasmuch as it is somewhat shorter and has to bridge the Copper but once. Katalla is only 1,200 miles distant from Puget Sound, as compared with 1,350 for Cordova Bay. On the other hand, at Cordova there is an excellent natural harbor, while at Katalla a breakwater will have to be constructed. On the other hand, again, a harbor at Katalla would serve the Controller Bay coal field. Whichever line is built, certain it is that there is not room for two railways along this Copper River route.

VALDEZ-COPPER RIVER ROUTE

An alternate plan for reaching the copper belt of the Chitina region is to build a railway from Valdez. Valdez Inlet, a northeastern arm of Prince William Sound, is 1,400 miles distant from Puget Sound. Surveys have been made and some construction work has already been done on two railway projects which are planned to cross Marshall Pass, about 1,900 feet high and 30 miles from Valdez, and thence down the Tasnuna River to the Copper (see profile, page 179). From the mouth of the Tasnuna the route would correspond with the route up the Copper River. The distance from Valdez to the mouth of the Chitina is about 20 miles less than from Cordova, but a pass 1,900 feet in height has to be crossed; on the other hand, two expensive bridges over the Copper would not be needed. This line would not reach the Controller Bay coal field.

Most of the railway projects into the Copper River have been planned with the ultimate object of extension into the Yukon basin. Some of these have chosen Eagle, other Fairbanks, as their ultimate objective point. Of the two, Eagle ap-



Photos by W. C. Mendenhall and L. M. Prindle

Camp on Bank of Copper River, Showing Character of Timber

Potato Patch at Baker Hot Springs, Tanana Valley

Photos by G. K. Gilbert and F. C. Schrader

Mt Perouse and Glacier

A typical view of the coastal barrier of Alaska

Mentasta Pass, on the Railway Route from Copper River to the Yukon

pears to be the less logical, as a line built to it would pass through the eastern part of the auriferous district, while Fairbanks is much more central.

From the mouth of the Chitina a line to Eagle would follow the Copper River valley and cross to the Tanana through Mentasta Pass, 2,900 feet high (see illustration, page 184). Crossing the Tanana Valley, the line would enter an upland region not well known and would probably have to cross two passes, 3,000 feet high, before it descended to the Yukon.

A line to Fairbanks would be built up the Copper and Gakona River valleys across a pass 3,000 feet high, and down the Delta to the Tanana. Crossing that stream, it would continue down it to Fairbanks.

RESURRECTION BAY-SUSITNA VALLEY ROUTE

The upper waters of the Susitna River, which empty into Cook Inlet, are separated by a broad, low pass, about 2,400 feet high, from the Ninana, or Cantwell, River, which flows into the Tanana. This is one of the lowest depressions in the watershed between the Pacific and the Yukon.

Unfortunately the upper part of Cook Inlet is closed by the winter ice, so that a coastal terminal would have to be sought on the east side of the Kenai Peninsula, which separates Cook Inlet from the Pacific. Such a one has been found in Resurrection Bay, an excellent harbor, 1,400 miles distant from Puget Sound. Here the town of Seward was located two years ago and construction begun on the so-called Alaska Central Railway, of which about 50 miles has been completed and considerable work done on 20 miles more. This route stretches northward from Resurrection Bay and, crossing a pass, about 1,000 feet high, about 40 miles from the coast, descends again to tide-water at the head of Turnagain Arm. After swinging around Turnagain Arm, it bends northward, crossing the Matanuska near its mouth. Here a branch is to be built to Matanuska coal field, the immediate objective point of the railway (see map, page 170). It is proposed to extend the Yukon trunk line up the Susitna, across the depression above mentioned, down the Cantwell to a terminal which will be on the south side of the Tanana River, near Fairbanks. The total mileage from Resurrection Bay to Fairbanks is about 500. While this route is one of the shortest from the coast to Fairbanks and also has the best grades, it does not tap the copper deposits of the Copper River, and, with the exception of the Matanuska coal field and some placer districts, does not traverse an area now known to carry mineral in commercial quantities.

CONCLUSIONS

The matter presented shows that there is justification for a trunk line railway from the Pacific seaboard to inland points, for it is only by rendering accessible the vast mineral wealth of the interior that its full measure of development can be attained. It is evident that the value of such a trunk line would depend on the construction of many branches and feeders, which have not here been considered. Furthermore, these railways must be supplemented by many wagon roads.

The history of railway expansion in the United States has shown that the natural development is, first, railroads built supplementary to established lines of water transportation; second, the binding together of such auxiliary lines by a trunk system. In Alaska the same evolution is witnessed. The White Pass and Yukon Railway, traversing the coastal barrier, links tide-water with navigable waters of the Yukon system. The heavy traffic being all down stream, what should be a comparatively cheap form of transportation is established to Dawson, a distance of 700 miles. A placer field such as the Klondike yields practically no outgoing tonnage. When, however, lode or coal mines are developed, there is a return traffic which the upstream river steamers cannot handle economically. Moreover, freight shipped to Alaskan points on the Yukon must run the gamut

of two custom-houses, with all the attending annoyances of delays and formalities. It should be remembered, too, that the route to Fairbanks *via* the White Pass Railway involves the transhipment of freight at White Horse to Canadian steamers, a journey of 500 miles to Dawson, then a transhipment to American boats and another journey of 800 miles, of which 200 miles is upstream. If good connections are made, some eight days are consumed in going from tide-water on Lynn Canal to Fairbanks, which by a direct line could be reached in 450 miles. As a rule, freight is at least a month in transit. The journey up the river, while it avoids one transhipment, involves changing from ocean vessels to river steamers at the mouth of the Yukon, and then a 1,200-mile upstream journey. Moreover, these routes are only open from the first of June to the middle of September. It would seem, therefore, that if the resources of the Yukon are sufficient to warrant the construction of a railway, such a railway should hold its own against the competition of water transportation. In any event, a railway into the Susitna-Copper River province would encounter no competition with steamboat transportation.

Considered geographically, the routes described fall into two classes, namely, the one comprising those parallel to the lines of height, and the other those transverse to the lines of height. In the first group belong the trans-Alaskan-Siberian line, the Lynn-Canal-Fairbanks line, together with its alternate, the Alsek-Fairbanks line.

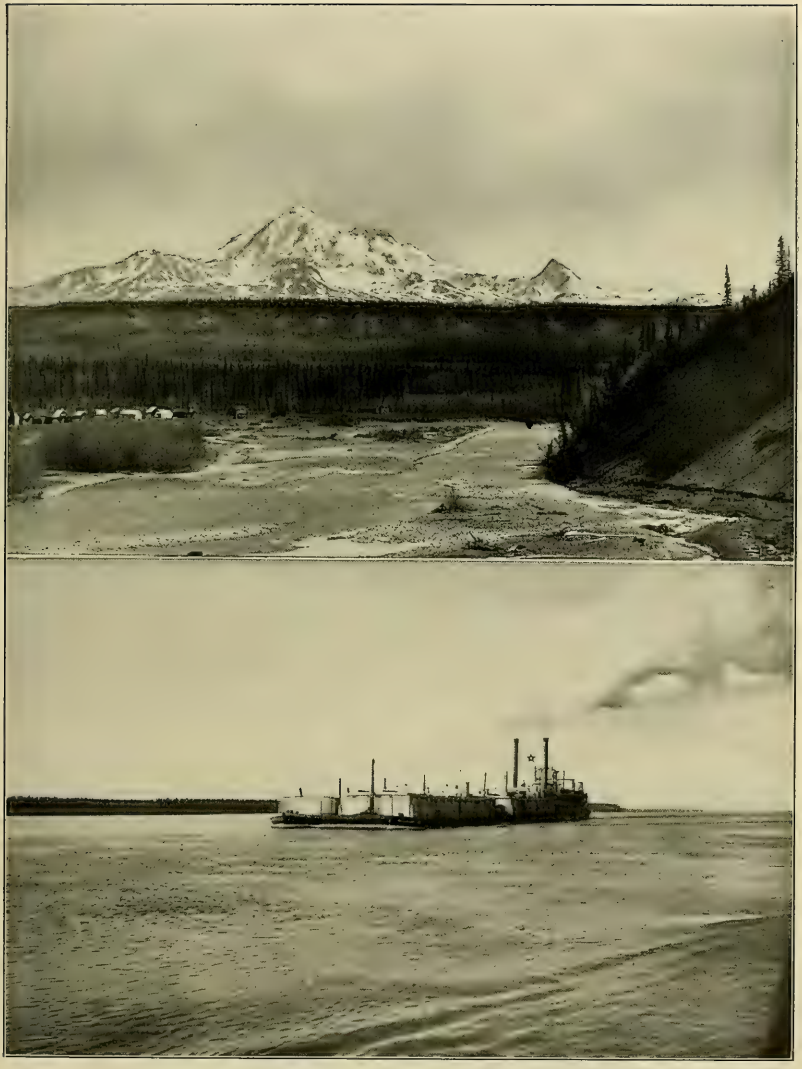
These routes, as has been shown, are parallel to the dominant axes of uplift, and therefore harmonious with the topography. As a matter of fact, however, pioneer railways are usually transverse to the watersheds, for the reason that they are located to supplement and not to supplant water transportation. The history of railway development in the United States shows that piedmont lines are the last to be built. A railway parallel to the inland front of the Saint Elias range would traverse a series of abandoned valleys such as are everywhere recognized as ideal topographic conditions.

Geographically, therefore, these routes would appear to have the advantage, and would, moreover, render accessible a large area in the interior of Alaska and northwest Canada not reached by any railways of the other group. When, however, the *developed* resources are considered, they are at a disadvantage, for while they would tap the upper copper-bearing region, they would reach neither the valuable southern copper belt nor the coal fields.

The transverse lines, including the Copper and Susitna routes, appear, as has been shown, to follow the laws which govern the location of pioneer railways; that is, they cross the watersheds and connect existing lines of water transportation.

In any event, it is clear that a properly located transverse line must follow one of the rivers which traverses the coast ranges. Two such railways, one up the Copper and one up the Susitna, are already under construction. The rival interests financing the two projects have been loud in claiming that each route was the best. In point of fact, the two supplement each other. It is certain that a railway by way of the Copper River follows the only feasible route to copper deposits of the Wrangell region. It is equally certain that as a route to the Yukon a railway up the Susitna River has the best of it. Again, neither of these lines bisect Alaska as would a railway extending from Lynn Canal to Fairbanks and to the Seward Peninsula.

The matter presented in the foregoing pages indicates that more facts are needed before scientific deductions can be drawn of the best route *for immediate construction.* Meanwhile, however, in view of the large amount of capital ready for investment in any promising enterprise, it is only too likely that the problem will be solved by experimentation alone, as has been done at great cost elsewhere; in other words, by the survival of the fittest.



Photos by W. C. Mendenhall and L. M. Prindle

Copper River Valley at Copper Center, on the Railway Route from Copper River to the Yukon

Freight Steamer and Barges on the Yukon River

Photo by W. C. Mendenhall

White Horse, Inland Terminal of the White Pass and Yukon Railway

This town is 6 years old. It is of about the same latitude as St Petersburg

The Interior Plateau Region of Alaska, Charlie River Basin

Photo by L. M. Prindle

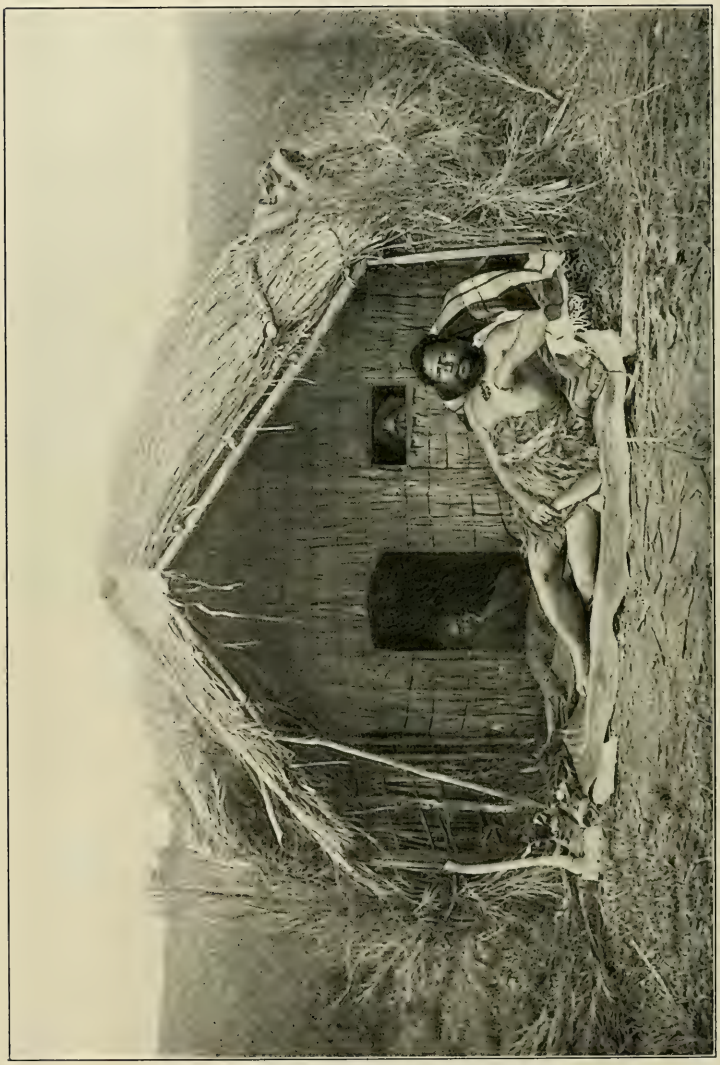
Miles Glacier, Copper River

Photo by F. C. Schrader

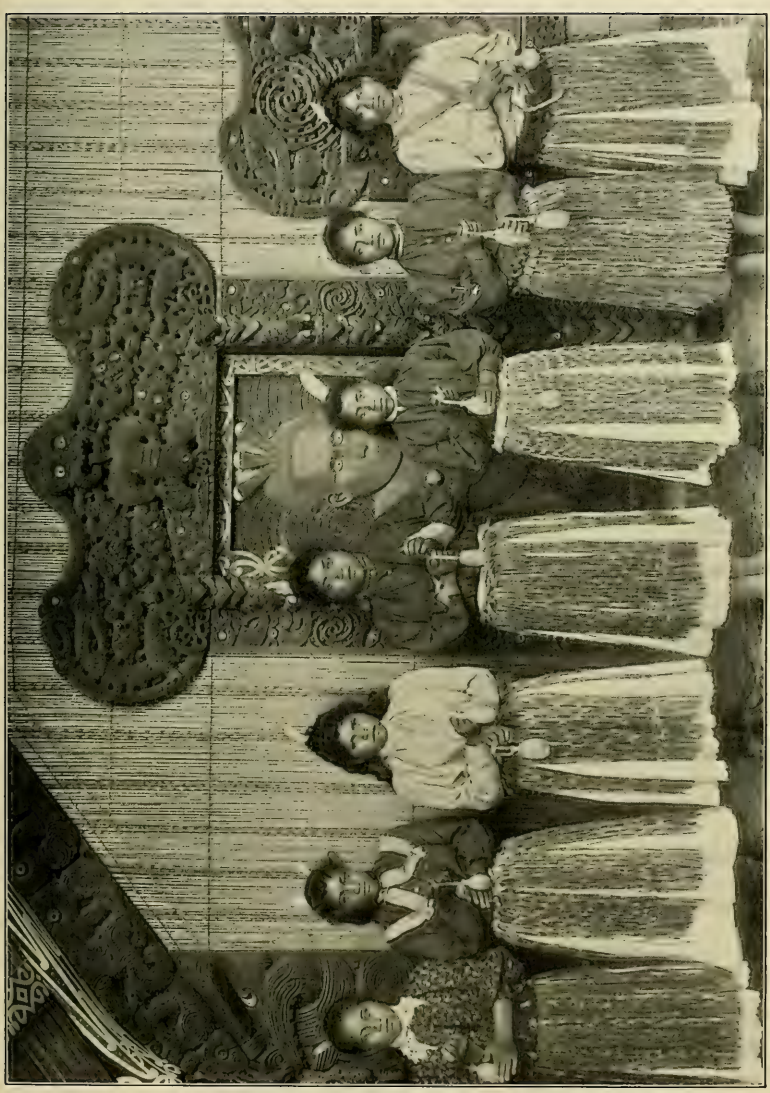
A Maori Girl (see page 198)

The Chief of One of the Most Celebrated Maori Tribes, Showing Their Remarkable Tatooing

A Maori Mother and Child



A Maori Hut



A Group of Maori Girls, Maori Carving in the Background

Two Maoris Saluting

The Daughter of a Maori Girl and White Man

THE MAORIS OF NEW ZEALAND

THE Maoris are in many respects the most remarkable savages with whom the white man has come in contact. Fifty years ago cannibalistic feasts, at which the flesh of their fallen enemies was served, were not uncommon. Today several members of their race are members of the New Zealand Parliament, and Maori women, as well as the white women of New Zealand, exercise the right to vote.

When the English first occupied the islands, in the early part of the nineteenth century, it is estimated that there were about 100,000 Maoris in New Zealand. They were divided into tribes, each tribe having its own unwritten laws regarding land, cultivation, and other social matters. The tribes were constantly fighting. The English found that they had a genius for war, showing unusual ability in building, fortifying, and defending stockades, and they experienced considerable difficulty in subduing them. The Maoris were also skilled in several arts: They tilled the soil with great care; as carvers and decorators they were unrivaled in the Oceanic world, and they displayed great originality in the design and perfection in the execution of rock paintings, and in carving the ornamental figures of their dwellings, their boats and sacred inclosures. Many of these objects are carefully preserved in museums.

But the Maoris were also noted for their remarkable tattooing, which was designed to clothe as well as decorate the body. The Maori artist knew how to give endless variety to the curves of his drawings; the natural furrows, the movements of the countenance, the play of muscles—everything was made to enhance the charm of the design; and a hale young man certainly presented a fine sight, draped only in this delicate network of blue lines on the ruddy brown of his skin. Whoever refused to undergo the protracted tortures of tattooing required at every important event of his life was regarded as a person by his own consent foredoomed to slavery. The men were actually depilated in order to increase the surface to be covered with ornamental tattooing, while for young women the operation was limited to the lips, whence the term *Blue lips* applied to them by the English.

There are about 35,000 Maoris left.

Maoris Practicing the Old War Dance

These have retired to the northern provinces of New Zealand, where certain "reservations" have been set apart as their exclusive property. Schools have been established which the Maori children attend regularly. It is said that such of them as continue into the higher branches of learning are worthy rivals of white students. Some of the Maoris have become large landed proprietors; they are proud of their right to vote, and especially of the fact that their women were given this privilege at the same time that it was given to the white women of New Zealand, in 1893.

The preceding illustrations of the Maori of New Zealand were taken by Mr J. Martin, of Auckland, and were sent to this magazine by M. Maurice Loir, editor-in-chief of *Le Tour du Mond,* of Paris.

THE GREAT NATURAL BRIDGES OF UTAH

IN the summer of 1904 the first public announcement was made in the *Century Magazine* and the NATIONAL GEOGRAPHIC MAGAZINE by Mr W. W. Dyar of the discovery in Utah of three great natural bridges, far surpassing in size the great Natural Bridge of Virginia and all other similar bridges known in the world. The article was illustrated from small photographs, and was based on a hurried view of the bridges. Last year a member of the National Geographic Society, Mr Edwin F. Holmes, equipped an expedition with surveyors and artists and sent it out to make a careful study of the bridges. Mr Holmes' report of the work done is printed below.

The three great natural bridges are located in an almost inaccessible portion of southeastern Utah, in San Juan County, lying south of the Colorado and Grande rivers.

The country is uninhabited and uninhabitable for the greater part, the only settlement of any account being the small town called Bluff, on the San Juan River, and the nearest railroad being Dolores, in Colorado, some 105 miles eastward, on a narrow-gauge branch of the Denver and Rio Grande and Rio Grande Southern, extending from Grand Junction to Durango, in the silver San Juan country. There is another small settlement, called Monticello, to the north of Bluff, with which it is connected by a wagon road, and on to Moab on the Grand and to Thompson's Spring on the main line of the Denver and Rio Grande Railway.

The country of the natural bridges can be reached *via* Bluff by either of these routes, going by wagons to the latter place, then by horses with pack train, taking a northwesterly direction from Bluff for a distance of about 65 miles, going south of the Blue Mountains and Elk Ridge, crossing Cottonwood Creek, and going up Comb Wash.

There might be a way of reaching this section by crossing the Colorado at Dandy Crossing, near Hite, in Garfield County, striking the White River Canyon some 60 miles below the Caroline Bridge, which, with the Augusta, is situated on the main canyon of the White River, while the Edwin Bridge is situated on Armstrong Creek at its confluence with a small stream coming in from the north. Armstrong Creek itself discharges in White River a few miles lower down. All three bridges are within a radius of about 20 miles.

A few miles above the Edwin Bridge, on Armstrong Creek, are the remains of ancient ruins, and about here are hieroglyphics cut into the rocks. No person should think of going into this region without having thoroughly studied all the conditions. The few guides that have been there have a very limited knowledge of the country, and the main and side canyons so cut up the country

The Augusta Bridge

The greatest natural bridge in the world; height, 265 feet; span, 320 feet; width in narrowest part, 35 feet; thickness, 83 feet.
This and succeeding illustrations are from paintings of the bridges based on careful measurements

Caroline Bridge

The longest natural span in the world—350 feet

The Edwin Bridge

Height, 111 feet; span, 205 feet; width, 30 feet; thickness, 10 feet

that a party may easily become lost. The absence of forage and at times of water make it necessary to undertake the trip as early in the spring as possible, ten or fifteen days being about the limit of time one can spend here because of the impracticability of packing a sufficient supply of forage and provisions. Of course, a more extended trip could be provided for by keeping pack animals on the road to and from the base of supplies at Bluff, the only or nearest place where a suitable outfit can be obtained.

The Augusta Bridge was so named in honor of the wife of Horace J. Long, who in 1903 visited the bridges in company with James Scorup. They made approximate measurements, but, not having accurate instruments, their work was necessarily faulty, and their pictures were taken with a small Kodak, much too small for the purpose. Mr Scorup, it appears, had visited these bridges previous to this time, and in showing Long the way to them stipulated that the second one should be named the Caroline, after his (Scorup's) mother.

So far as Scorup knew, the bridges were first discovered by Emery Knowles in 1895, and he himself visited them in company with two cowboys, Tom Hall and Jim Jones, in the fall of that year.

The next party to visit this section, so far as known, was that promoted by the Salt Lake City Commercial Club during the winter and spring of 1905. The members of the party were H. L. A. Culmer, artist; S. T. Whitaker, photographer; Carleton Woods Holmes, son of Col. Edwin F. Holmes, ex-president of the Salt Lake Commercial Club, who first suggested the trip, and Scorup, guide, together with two packers and a cook. The party was well equipped with scaling ladders and all the necessary paraphernalia.

The measurements taken of the Augusta Bridge were as follows: Height, 265 feet; span, 320 feet; width in narrowest part, 35 feet, and thickness, 83 feet.

The measurement of the Caroline Bridge the party found to be: Height, 182 feet; span, 350 feet; width, 60 feet, and thickness, 60 feet, while of the smaller bridge, named by the Culmer party as the Edwin Bridge, for Col. Edwin F. Holmes, of Salt Lake City, they found the measurements to be: Height, 111 feet; span, 205 feet; width, 30 feet, and thickness, 10 feet, this bridge being the much more graceful and slender of the three.

Oil paintings of the three bridges have now been completed by artist H. L. A. Culmer, from photographs, sketches, water colors, and measurements taken at the time of the visit, the measurements having been corroborated from the records kept by two different persons of the expedition. The painting of the Augusta is a canvas 60 x 90 inches and has the noonday or mid-afternoon tints, with storm-cloud approaching from the southeast—an incident that actually occurred at the time of their visit. Great buttes and the high canyon walls are seen underneath the arch and great cottonwood trees in the distance.

The two other bridges are on canvases 42 x 60 inches in size, the Caroline being in a rich sunset glow of color, with parts in shadow, very dark, somber, and heavy in tone; the sky without clouds, but luminous with light from the setting sun. Little but rock and sky appear in the picture, the little green foliage in the dim distance being so far away as to show but faintly.

Of the Edwin Bridge the dominant tone of rock color is a creamy gray, with a purplish tint in shadow and interesting perspective beneath the arch, showing trees of mountain pine and cedar in the distance and near foreground. The sky of blue is marked by cloudlets of indistinct outline, all in the sunshine of midday.

These bridges, composed as they are of light sandstone, might seem to be wearing away very rapidly. Such, however, is not the case, as is evidenced in the

caves beneath the Caroline abutments, especially that to the south or west, where was found what may have been a workshop of the ancients, for evidences of their pottery work were scattered around, and at one place a number of fiber sandals were found in a fair state of preservation.

A few miles above the Edwin Bridge a considerable settlement of Cliff-Dwellers once existed, and rude symbols are found on the rocks in the vicinity of the bridges.

A NATIONAL PARK SUGGESTED

From all that is learned of this wonderful country, it is believed that its preservation and care should be undertaken by the United States Government, as in the case of the Yellowstone National Park, so that roads may be opened and these greatest of the world's natural bridges can be made accessible for the tourists from our own country and from all over the world, who would flock thither were the road made easier. The difficulties of railroad building do not seem to be unsurmountable, and an extension from Dolores, on the main line, is possible, even to a continuation through to the Santa Fe System, embracing all of the upper part of the Grand Canyon of Arizona—a scenic route comparable to nothing else in the world.

More than a passing word should be said about the little town of Bluff, on the San Juan River, from which point an expedition can best be fitted out for the Bridge Country. This is a place of about fifty houses, and is a thrifty little town with some excellent stone dwellings, some of them costing $5,000 to $10,000. The inhabitants of the town are generally well to do and kind in their treatment of strangers, and their prosperity is largely due to the cattle industry. They are on the northern border of the Navajo Indian reservation, having considerable barter trade with the Indians, who work for them cheaply and keep their dwellings for them. The people are mostly Mormons. Their young people are educated abroad and compare favorably with the young people anywhere.

Quite the opposite is the little town of Monticello, some 50 miles to the north and the county-seat of San Juan County, which is a town of about a dozen houses, some occupied and some not, built upon the apex or divide of a mountain range and formerly the headquarters for the cattle interest of this section. Its nearest point also is Dolores, which is south and east some hundred miles or so and connected by a wagon road little used.

There are mountains about here—Abajo, 11,445 feet, and Mount Linnæus, 11,000 feet—while farther north, toward Moab, are Mount Tukuhnikivatz, 12,004 feet; Mount Tomaskia, 12,218 feet; Mount Wass, 12,586 feet, and Mount Peak, 13,089 feet. Much of this portion has been surveyed, though the townships have not been sub-divided, but nearly all of the western part of the country is still unsurveyed and no very accurate maps exist, excepting of the courses of the Green, the Grand, and the Colorado rivers.

A RECENT REPORT FROM THE "DOUBTFUL ISLAND REGION"

By James D. Hague

THE San Francisco *Chronicle* of February 5, 1907, contained the following item:

"Captain Maurice Rose, of the French bark *Michelet,* reports to the branch hydrographic office that at 9 a. m., January 18, when in latitude north 22 degrees 19 minutes, longitude west 131 degrees 6 minutes, off the Mexican coast, he passed within 200 yards of a reef over which the sea was breaking for an extent of about fifteen yards. The weather was clear, wind northeast, light, with a light swell. He took no soundings. The chronometer was correct upon arrival in port. The observations by which the position was fixed were good."

The locality thus indicated by the above-stated latitude and longitude would be little less than 3½ degrees of latitude north and about 5 degrees of longitude east of the reported shoal which Captain Lawless thought he saw on the morning of March 17, 1902, in latitude 18 degrees 56 minutes north and longitude 136 degrees 10 minutes west, but which the U. S. S. *Tacoma,* when searching for it two years later, failed to find in that position or near neighborhood, May 28, 1904, as set forth in the National Geographic Magazine for December, 1904.

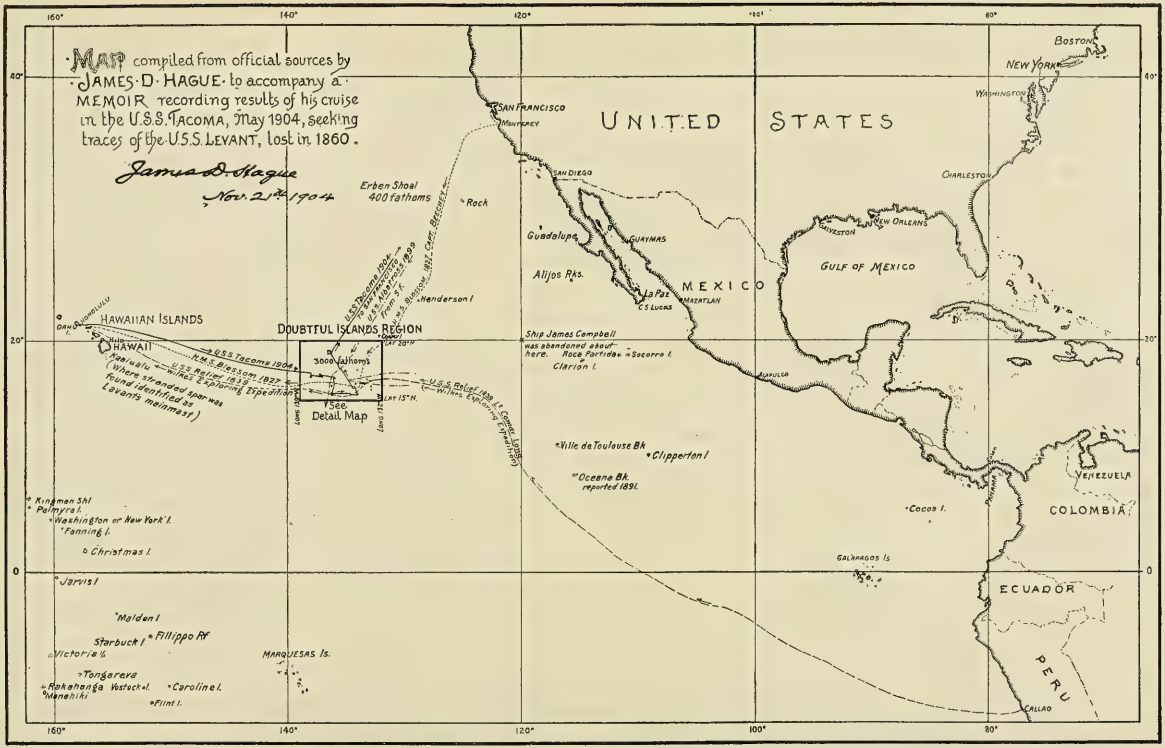
The recently reported reef, over which the sea was breaking, as above stated, would not be far distant (2 or 3 degrees northeasterly) from "Cooper's," one of a number of small islands, of doubtful position and questionable existence, indicated on the older charts, published 50 years ago or more, and it furnishes one more new item of evidence, certainly indicating the possible existence of a shoal region in this neighborhood, within which there may yet be found and definitely located one or more of the score of reefs and islands, which have been reported, mainly by whalemen, from time to time during the past hundred years, but so far never found by any of the exploring vessels sent to look for them.

On such a reef as this the long-lost *Levant* may have met her mysterious fate in 1860, and in this still unexplored sea there well may be not only similar reefs, but, as reported, larger and higher islands—possibly some habitable island—on which surviving castaways of the shipwrecked *Levant* may still be watching for a sail.

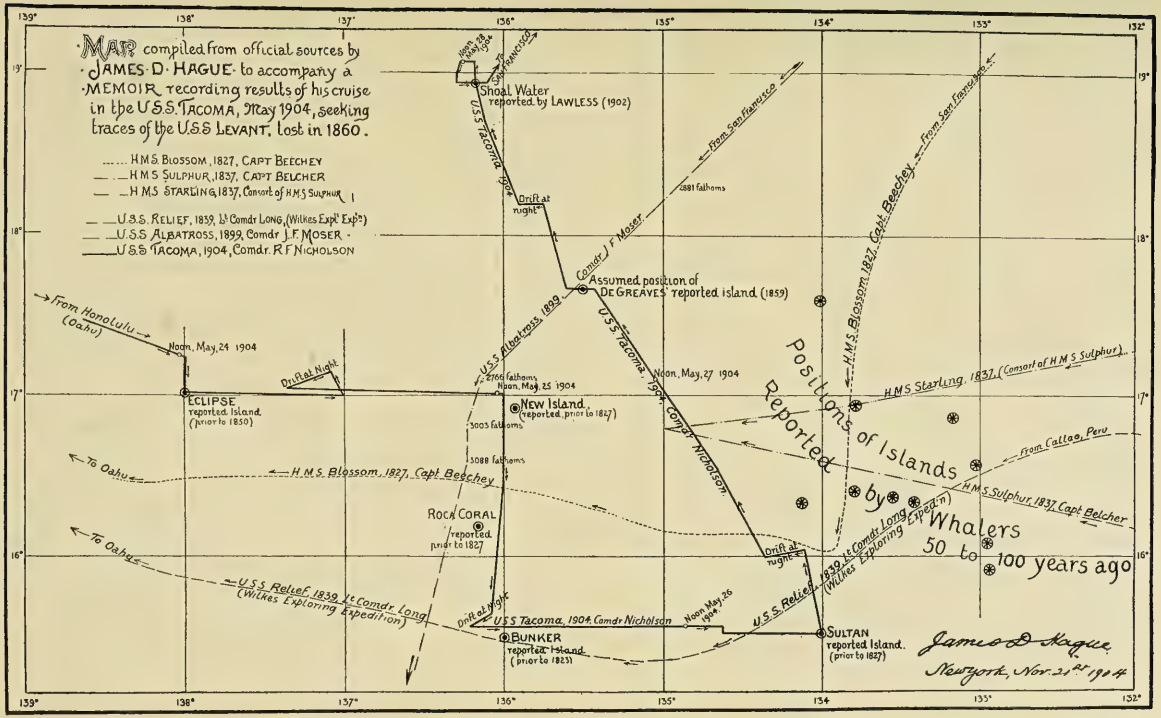
This new report is one more call from far midocean for renewed search and thorough survey of this unexplored region, with the purpose either to prove the non-existence of these most dangerous menaces to navigation or, if found existing, to locate them correctly on the charts, in the interest of commerce and for the benefit and safety of mariners.

The brief and only partial search of this region, made by the *Tacoma* in 1904, occupied only four days in cruising and covered but a comparatively small part, about 8,000 square miles, of this doubtful island region, leaving 20,000 to 30,000 square miles still unexplored and almost wholly unseen by any of the several vessels sent there for exploration. Every square mile of this region must yet be seen in daylight before it can be certainly known that there are no reefs or islands to be found or feared there by passing navigators. The search of the *Tacoma* was conclusive only for a part of the field, as above stated, and there are better reasons now for completing the exploration than there were originally for beginning it.

Although no sign of shoal water was found by the *Tacoma* at the place indicated by Captain Lawless, he still be-



Map Showing Relative Position of Doubtful Islands Region, the Hawaiian Islands, and the American Coast



Map Showing Assigned Positions of Reported Islands in the Doubtful Region, and the Sailing Tracks of Vessels Sent to Seek Them

lieves that what he saw and reported was in fact a shoal, but probably located a few miles out of his reckoning. He did not stop his ship to sound, but estimated the depth of water on the shoal to be thirty to forty feet, or, say, five to seven fathoms; and it is curiously interesting to note the singular coincidence between this estimate and the depth of "six or seven fathoms" actually found by sounding on another remotely related shoal observed and reported many years since, a recent reference to which is contained in a letter from Professor George Davidson, at San Francisco, an eminent authority on oceanography, who writes:

"Yesterday (January 9, 1906) I was browsing among old navigators, and in Burney, vol. I, pages 228 and 229, I came on the following, in the voyage of Villalobos: 'Dec. 3 (1542) they discovered banks on which they had only six or seven fathoms.' The pilot's statement: 'and we sailed beyond Roca Partida about two hundred leagues, when we had soundings in seven fathoms, being then in 13 degrees or fourteen degrees north latitude, and no land in sight; but we believed ourselves to be near the Island San Bartholomeo.'"

This observation antedates Captain Lawless's by three hundred and sixty years; but it is somewhat more reliable than his, because of the actual soundings that were taken at the time, which have the same important significance as if made yesterday. Such a shoal is evidence of an elevated sea bottom and is an indication of a shoal region, in which there may be coral reefs near enough to the surface to menace navigation, and where there might be islands, possibly habitable, and, in that case, now inhabited by the survivors of shipwreck. In fact, during the three hundred and sixty years of elapsed time a coral island may have been formed on this same shoal. Such an island, developing conditions favorable to the support of life, like scores of tropical islands elsewhere, might have become habitable long ago.

The region from which this report apparently comes (two hundred leagues westerly from Roca Partida, shown on the charts) is perhaps ten degrees east and eight or more degrees south of the assigned position of the reef over which the sea was breaking, as recently reported by Captain Rose of the bark *Michelet;* but it is within the great, generally landless, ocean area of which we have but comparatively little information and hardly any knowledge concerning the elevations and depressions of the sea bottom.

The traffic of this hitherto-unfrequented region is steadily increasing. Steamships between San Francisco and Tahiti traverse it occasionally in northerly and southerly directions, and the American-Hawaiian Steamship Company has just now inaugurated a fortnightly service between Hawaii and the Mexican coast, which will pass through this region in easterly and westerly courses; and when the Panama Canal is open for business the movement of ships in these waters will be constant. With these conditions in view, it seems obvious that a complete survey of the region should presently be made in the interests of commerce and navigation.

THE POSSIBILITIES OF THE HUDSON BAY COUNTRY

THE Canadian Geological Survey has issued a popular narrative and report of its recent expedition to Hudson Bay and the Canadian Arctic Islands by Hon. A. P. Low, the leader of the expedition and now Director of the Geological Survey of Canada.*

One reason for the expedition was the formal assertion and installation of Canadian authority over that drear coast and its adjoining waters, a domination which previously had been largely taken for granted, so far as the islands north of Hudson Bay were concerned. Another important reason for the expedition was the securing of further information about the navigability of Hudson Bay. Other reasons were to obtain scientific information about the geology, botany, and natural history, minerals, and timber of the vast territory, about its inhabitants, the Eskimos, and about the possibilities of fishing and whaling, the latter of which has been the sole industry of the northern seas or their neighborhood.

The report makes an exceedingly valuable volume of 350 pages and is illustrated with about 75 pictures of Arctic scenery, of the Eskimos, and whaling views. There are excellent chapters on the Eskimos, the whaling industry, and a very good historical summary of previous explorations of the Hudson Bay region. Mr Low also publishes a large map of the region.

All that is needed to open Hudson Bay for ordinary commercial navigation, says Mr Low, is a line of rails to carry freight to one of its ports. At present the Hudson's Bay Company and the Revillon Fur Company have ships going annually to the bay, and a greater amount of freight would attract more steamers.

The period of safe navigation for ordinary iron steamships through Hudson Strait and across Hudson Bay to the port of Churchill may be taken to extend from the 20th of July to the 1st of November. This period might be increased without much risk by a week in the beginning of the season and by perhaps two weeks at the close.

The fur trade with the Indians and Eskimos living about Hudson Bay or along interior routes tributary to it has for a period extending over two centuries and a half furnished cargoes for two or more ships belonging to the Hudson's Bay Company. At the present time two ships are engaged in this trade for the company, while Revillon Brothers employ two more. The whale fishery now supports two ships. These four ships represent the developed trade of the bay and strait at the present time.

The undeveloped resources of the region surrounding these waters appertain to mining and fisheries and to the forests, which include large areas of pulp wood and merchantable spruce. Iron ores and copper-bearing rocks have been found in several places and a valuable mica mine is being worked. Not much is known about the fisheries, but sea run trout, whitefish, Arctic salmon, etc., are believed to be abundant.

These undeveloped resources of the north will no doubt, when developed, add greatly to the annual shipping of Hudson Bay, but the main increase to the fleet will be due to the products of the great plains of the Northwest, now rapidly filling with robust settlers. These products of the western farms—grain, butter, and cattle—will naturally seek the shortest road to the European markets; a road not only shorter, but, owing to its cool climate, capable of landing perishable products and grain in better condition than the more southern routes.

Taking Regina as a convenient center for these northwestern farming lands, the

*The Cruise of the *Neptune*. By A. P. Low, Officer in Charge. Pp. 350. 6x9 inches. 75 illustrations and one map. Ottawa, Government Printing Bureau, 1906.

Photo from "The Cruise of the *Neptune*," by A. P. Low

The Interior of an Eskimo Snow House, Showing the Snow Blocks of which it is Constructed. Cape Fullerton

Copyright, 1905, by John M. Phillips.

The Goat at Ease

Distance eight feet. All these photographs of a living mountain goat were taken September 15, 1905, with Stereo Hawk-Eye Camera, No. 1. No telephoto lenses used.

From Alpina Americana

Tehipite Canyon

From a point 4,000 feet above the river. Photographed by G. K. Gilbert. The clean white granite walls rise from 3,000 to 4,000 feet above the level floor

distance from there by way of Prince Albert to Churchill is about 800 miles, or the same distance as from Regina to Fort William, on Lake Superior, and a thousand miles shorter than the distance from Regina to Montreal, at the head of sea navigation on the Saint Lawrence. The distance from Churchill to Liverpool is almost the same as that from Montreal to Liverpool; consequently there is a saving in distance of a thousand miles of rail or river carriage in favor of the northern route.

The question of the storage of the grain until the season following the harvest is at first sight a serious one, but when it is known that not twenty per cent of the grain at present reaches the seaboard before the opening of navigation of the year following that in which it is harvested, this objection practically disappears, for the grain may be as well stored on the shores of Hudson Bay as in the elevators on the plains or at Fort William.

THE HIGH SIERRA

ALL lovers of mountain scenery and mountain climbing will be interested in a new publication, *Alpina Americana,* established as a quarterly by the American Alpine Club, whose object is to encourage interest in our beautiful western mountains, and at the same time to teach how they may be best appreciated and enjoyed. The first number is entirely devoted to a monograph on "The High Sierra" by Professor Joseph N. Le Conte, of the University of California. It is illustrated with some excellent views, and also contains a map of the mountains prepared by Mr Le Conte. Prof. Charles E. Fay, of Tufts College, the editor, and the editorial committee deserve much gratitude from the public for their generous support of this worthy undertaking.

Professor Le Conte gives a highly instructive account of the Sierra, describing their geological history, their scenery, and the best means of exploring them. The following paragraphs are abstracted from his article:

The Sierra Nevada forms a part of the western bulkwark of that great continental plateau upon which is built the North American Cordillera. Though it is but one of the many ranges within the boundaries of the United States, not one surpasses, if any equals, the Sierra when extent, altitude, and grandeur of scenery are taken into account. It is one of the great features of the earth's surface, standing in remarkable isolation, wonderfully simple in general outlines, and fascinating alike to the scientist, mountaineer, nature lover, and, in fact, to any one who has once penetrated its deepest recesses.

The Sierra Nevada, as generally defined, is limited strictly to California, and may be considered to extend from the Tehachapi Pass (latitude 35° 10′) to Mt. Shasta (latitude 41° 25′), a distance of over 500 miles along the eastern border of the state. The exact termination to the north and south cannot be clearly defined, as its spurs mingle with those of the Coast Range in those portions; but throughout its central part it forms a single, isolated mountain mass, extending from Tejon Pass (latitude 35° 45′) to Lassen Peak (latitude 40° 30′), a distance of about 385 miles. Between these points the crest line, which is the hydrographic divide between the Pacific Ocean and the Great Basin, is nearly straight, as are also the lines, about eighty miles apart, which terminate its slopes on the east and west.

The range is one of the grandest known examples of the "basin" type of formation. It can be briefly characterized as a single block of the earth's crust upheaved along its eastern edge, and thus presenting to the west a long gradual rise covering nine-tenths of its entire area, and to the east a precipitous front of imposing dimensions. The total dissimilarity of the two slopes is perhaps its most striking feature. It is the result of its geologic history and is the primary cause of the peculiarly Sierran

type of canyon sculpture, of the regular distribution of the belts of vegetation, and of many characteristic features of the High Sierra scenery.

The western slope may therefore be considered the main portion of the Sierra Nevada, containing not only 90 per. cent. of its area, but also most of its great forest and mineral wealth, receiving nearly all the annual precipitation and giving rise to all its rivers.

During the Glacial times the High Sierra was completely covered with ice, and enormous glaciers filled its canyons, reaching in some instances for forty miles down its western flank. This ice mantle has vanished within very recent geological times, and the High Sierra exhibits to a most perfect degree the effects of this recent glaciation. Great areas are everywhere found polished smooth as glass and covered with glacial erratics. The canyons are all of the characteristic U-shape, with walls showing polished and scored surfaces. Large streams flow over smooth rock slopes without channels, and indeed the general appearance is as if the glaciers had vanished but yesterday.

At the present time three large national parks have been created on the western slope of the Sierra, the Yosemite National Park, which now includes the Yosemite Valley; the General Grant and Sequoia National Parks, which include some of the finest of the sequoia groves. The whole of the western slope, from the southern portions of the Kern Basin to Lake Tahoe, has been set aside as a national forest reserve. The creation of these parks and reserves has restored the magnificent flora of the Sierra, which previous to 1899 was in danger of total destruction through sheep grazing and forest fires.

The eastern crestline contains the two highest points in the state and the highest one in the United States, Mount Whitney, 14,499 feet, and Mount Williamson, 14,384 feet. As to the height of Mount Whitney, there is no longer a doubt, as it has been leveled up by the United States Geological Survey from two independent bases. It is of but little interest to the mountain-climber, however. Its ascent has always been easy, and within the past year a horse trail has been constructed to the summit. Mount Williamson is by far the more imposing of the two and affords a really interesting climb. Mount Tyndall (14,025 feet) and Mount Langley (14,042 feet) are both exceedingly easy of ascent.

MOTOR SLEDGES IN THE ANTARCTIC

A NEW South Polar Expedition is being organized by Lieutenant E. H. Shackleton, who was a member of the recent British expedition and also one of the sledging party who reached farthest south, 82° 17′. Mr Shackleton plans to leave England October of this year on a steam whaler, and to establish his winter quarters at the station used by the *Discovery* near Mount Erebus. His party will be limited to from nine to twelve men. Mr Shackleton introduces two innovations: The use of Siberian ponies, which Fiala found so useful in the north, and a specially designed motor car for traveling over the ice barrier. Mr Shackleton in his announcement says:

"A North China or Siberian pony is capable of dragging 1,800 pounds on a food basis of 10 pounds per day. A dog drags 100 pounds at the outside, and requires over 2 pounds of food per day. Therefore one pony drags as much as eighteen dogs, at less than one-third in weight of provision, and can travel comfortably 20 to 25 miles per day.

"The motor will be of a special type, taking into consideration the temperatures to be encountered and the surface to be traveled over. I would propose to take three or four ponies on the southern journey and the motor car. As long as the car continued to remain satisfactory, it alone would be used to drag our equip-

ment and provisions. If it broke down and could not be fixed up, then the ponies would take over the load.

"I would propose traveling at the rate of 20 to 25 miles a day, and feel assured that, providing the motor does its work, 82° 16′ S. I intend, every 100 miles, to drop a sledge load of provisions and equipment; so that, in the event of every means of traction breaking down except the men, we would only have 100 miles to go between each depot on return. The geographical South Pole is 731 miles from winter quarters, and allowing that we only go with the motor to 82° 16′ S., we would then practically be starting for the remaining 464 miles as fresh as if we were starting from the ship. What lies beyond 83° S. we cannot tell, but I am of the opinion that we can follow the trend of the southern mountains for a very long way south before they turn either east or west."

ORIGIN OF THE WORD CANADA

IN the "Memoirs of the Historical Society of Pennsylvania," vol. 12, 1816, John Heckewelder gives an account of the origin of the word Canada. He quotes from "Mr Zeisberger's papers" to the effect that he (Zeisberger) translates "the German word *stadt* (town) into the Onondago by *ganatage*." He surmises that by the substitution of K, and finally C for *g*, and *d* for *t*, the word may have been derived in some form of the Mohawk dialect. "So that it is highly probable that the Frenchman who first asked the Indians in Canada the name of their country, pointing to the spot and to the objects that surrounded him, received for answer *Kanada* (town or village)." The mistake made by the Frenchman, consisting in applying a term meaning specifically town or village, to the generic significance of country in general, and he "consequently gave to their newly-acquired domain the name of *Canada*."

In connection with an old French map, the date of which is not affixed, is a "Dissertation sur le Canada ou la Nouvelle France," from which the following is translated:

"Since the year 1504, when the French discovered this great country, they have given it the name New France. The Spaniards first made the discovery, but as they found nothing of any account in it after their visit, they readily abandoned it, and gave it the name Capo di nada—that is to say, the *Cap de rien*—whence has arisen, by corruption, the name Canada, which is now generally given to it on the maps."

Francis Parkman is inclined to the view of Heckewelder, although he does not mention that missionary's name (*Pioneers of France in the new world*, footnote on p. 184 of the 19th edition). He states definitely that the name Canada is "without doubt not Spanish, but Indian," and refers it to the Mohawk dialect, in which it means a *town*. "Lescarbot affirms that Canada is simply an Indian proper name, of which it is vain to seek a meaning. Belleforest also calls it an Indian word, but translates it *terre*, as does also Thivet."

N. H. WINCHELL.

BOOK REVIEW

Camp Fires in the Canadian Rockies. By William T. Hornaday, with 70 illustrations by John M. Phillips and 2 maps. Pages 350. 6 x 9 inches. New York: Charles Scribner's Sons, 1906.

Dr Hornaday has given an exceedingly entertaining description of one of the most beautiful sections of North America. It is only in the last few years that the mountaineer and sportsman has learned by personal investigation of the wonders of the Canadian Rockies, where the wild goat and mountain sheep are found. The volume is illustrated with some very remarkable photographs of mountain goats and mountain sheep, which were taken by Mr John M. Phillips, of Pittsburg, with an ordinary stereo-camera. Dr Hornaday describes very pleasantly his experiences in hunting this game and particularly the risks incurred by Mr Phillips to obtain his photographs. There are also interesting notes and photographs of the grizzly, porcupine, squirrel, wolverine, marten, grouse, mule-deer, etc. One picture from the volume is given on page 211.

DECISIONS OF THE UNITED STATES GEOGRAPHIC BOARD

The following important decisions relating to geographic names and their application were made by the United States Geographic Board on February 6, 1907. In reaching these decisions the Board has obtained the advice of many of the foremost American geographers and geologists, and the decisions here given are, in nearly all cases, the result of a consensus of opinion among the gentlemen consulted.

CORDILLERAS—the entire western mountain system of North America.

ROCKY MOUNTAINS—the ranges of Montana, Idaho, Wyoming, Colorado, New Mexico, and western Texas.

PLATEAU REGION—the plateaus of Colorado River and its branches, limited on the east by the Rocky Mountains, on the west by the Wasatch Range, and extending from the southern end of the Wasatch southward, southeastward, and eastward to the eastern boundary of Arizona, following the escarpment of the Colorado Plateau, and including on the north the Green River basin.

BASIN RANGES—all those lying between the Plateau Region on the east, the Sierra Nevada and Cascade Range on the west, and the Blue Mountains of Oregon on the north, including the Wasatch and associated ranges.

PACIFIC RANGES—the Cascade Range, the Sierra Nevada, and the coast ranges collectively.

SIERRA NEVADA—limited on the north by the gap south of Lassen Peak and on the south by Tehachipi Pass.

CASCADE RANGE—limited on the south by the gap south of Lassen Peak and extending northward into British Columbia.

COAST RANGE—extend northward into Canada and southward into Lower California, and include all mountains west of Puget Sound and the Willamette, Sacramento, and San Joaquin valleys, and southwest of Mohave Desert.

BITTERROOT RANGE—extends from Clarks Fork on the northwest to Monida, the crossing of the Oregon Short Line on the southeast, including all mountain spurs.

MISSION RANGE—range east and southeast of Flathead Lake, Montana.

WASATCH RANGE—includes on the north the Bear River Range, extending to the bend of Bear River at Soda Springs, Idaho, and on the south extends to the mouth of San Pete River near Gunnison.

SAN JUAN MOUNTAINS—include all the mountains of southwest Colorado south of Gunnison River, west of San Luis Valley, and east of the Rio Grande Southern Railroad.

SACRAMENTO MOUNTAINS—include those groups known as Jicarilla, Sierra Blanca, Sacramento, and Guadalupe.

SALMON RIVER MOUNTAINS—include the group in central Idaho lying south of main Salmon River, west of Lemhi River, north of Snake River, and east of the valley of Weiser River.

BLUE MOUNTAINS—include all the mountains of northeastern Oregon with the exception of the Wallowa Mountains, and extend into Washington.

SANGRE DE CRISTO RANGE—extends from Poncha Pass, Colorado, to the neighborhood of Santa Fé, New Mexico, thus including the southern portion locally known as the Culebra Range.

FRONT RANGE—includes on the north the Laramie Range as far as the crossing of the North Platte and on the south includes the Pikes Peak group.

APPALACHIAN SYSTEM—includes all the eastern mountains of the United States from Alabama to northern Maine.

BLUE RIDGE—includes the ridge extending from a few miles north of Harpers Ferry to northern Georgia.

APPALACHIAN PLATEAU—includes the entire plateau forming the western member of the Appalachian system, known in the north as the Allegany Plateau and in the south as the Cumberland Plateau.

OZARK PLATEAU—the plateau in northwestern Arkansas and southern Missouri.

QUACHINTA MOUNTAINS—the ridges of western Arkansas south of the Arkansas River, Indian Territory, and Oklahoma.

COMMITTEES OF 1907

The following committees of the National Geographic Society have been appointed by President Willis L. Moore for 1907:

Executive Committee.—President, Vice-President, Treasurer, Secretary, Messrs Blount, Grosvenor, and Henry.

Finance.—Charles J. Bell, John Joy Edson, Gilbert H. Grosvenor.

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Publications.—Gilbert H. Grosvenor, A. W. Greely, W J McGee, C. Hart Merriam, Willis L. Moore, O. H. Tittmann, O. P. Austin, Alexander Graham Bell, David T. Day, G. K. Gilbert, Angelo Heilprin, R. D. Salisbury, Alfred H. Brooks, Alexander McAdie, Almon Gunnison, David Fairchild.

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Library.—O. P. Austin, Gilbert H. Grosvenor, H. H. Kimball.

Excursions.—Henry F. Blount, F. V. Coville, Gilbert H. Grosvenor, Otto Luebkert.

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By ELIZA R. SCIDMORE

With a Series of 25 Typical Illustrations of the Far East

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THE NATIONAL GEOGRAPHIC MAGAZINE

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MILLIONS FOR MOISTURE*

An Account of the Work of the U. S. Reclamation Service

BY C. J. BLANCHARD

STATISTICIAN, U. S. RECLAMATION SERVICE

WE are living in an age of big things. It is a creative epoch. Our perspective has broadened to such an extent that it is no longer confined by fixed geographical lines. It embraces the whole world, the undiscovered Poles not excepted. It is the day of the engineer, and in no previous period of our history has he occupied so prominent a place in national affairs as he does today. The National Treasury and the surplus of huge corporations are at his command. Unafraid, he is proceeding to cut a great gash across a continent, through which the shipping of the world may pass. Eighty millions have been appropriated this year to deepen our waterways to relieve congested traffic conditions. He has tunneled the streets of our great cities for many miles to furnish readier transportation. Thousands of miles of steel are being laid to connect new regions with the nation's markets. We are today launched upon a policy of internal expansion which many have declared to be the most paternal ever attempted. Our government is actually loaning money to its citizens and making homes for them, and is loaning it as a father to a son—on long time, without interest.

On June 17, 1902, Congress enacted a law known as the National Reclamation Act. Briefly, this act provided that the money received from the sales of public lands in fourteen arid states and two territories should be used as a reclamation fund for the construction of the works necessary to irrigate arid lands in those states and territories. By wise provisions in the law this fund was made revolving. As soon as any work is completed the owners of land benefited must begin to return the cost thereof, payments being made in ten annual installments without interest. The money so returned

*An address to the National Geographic Society, March 11, 1907.

can be used over and over again in the construction of other works. To eliminate speculation and to put a stop to the greedy acquisition of large areas, it was further provided that no man could own more than 160 acres under any of these works, and such owner must actually reside upon and cultivate his land.

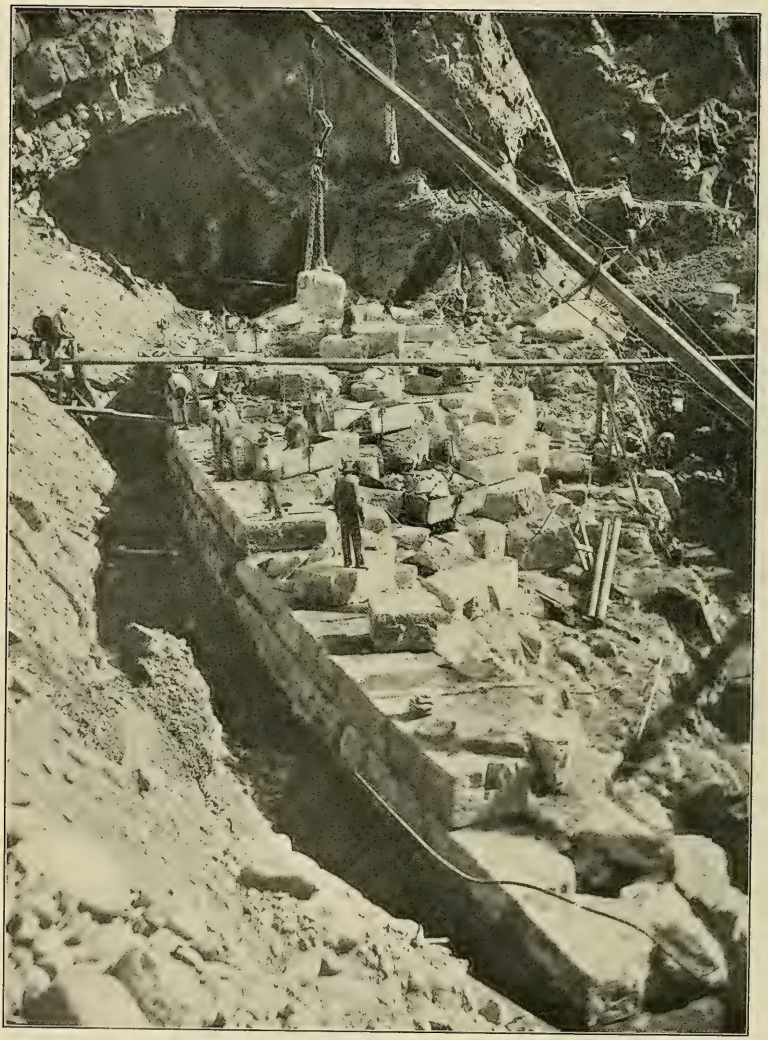
The policy of national irrigation is broadly paternal, yet it is so thoroughly common sense and business-like that the wonder is it was not adopted long ago. With the examples of other nations in similar works constantly before us for years, it is well nigh inexplicable that our nation, the most progressive in the world, should have been so tardy in initiating the work upon which it finally engaged less than five years ago.

THE PROJECTS UNDER CONSTRUCTION WILL RECLAIM AN AREA EQUAL TO THE TOTAL ACREAGE IN CROPS OF CONNECTICUT, MASSACHUSETTS, NEW HAMPSHIRE, AND FLORIDA

The full importance of national reclamation is obtainable only by comparison. The twenty-five projects upon which the government is now engaged, when developed to their full extent, will add 3,198,000 acres to the crop-producing area of the United States. Add to these thirteen other projects which are held in abeyance, pending the completion of the first mentioned, and which will reclaim 3,270,000 acres, and we have a grand total of 6,468,000 acres. This enormous area today is practically worthless. It returns revenues neither to the states in which it is located, nor to the nation to which it largely belongs. It is utilized only a short period in each year for grazing nomadic herds that are driven over it. Potentially, it is the richest, the most fertile and productive land in the world, and is capable of supporting in comfort an agricultural population as dense as can be found in any of the older settled parts of our country. By expending $60,000,000 on the 25 engineering works now in process of construction, the Reclamation Service will reclaim 3,198,000 acres, or a cultivated area equal to the total acreage in crops in the four states of Connecticut, Massachusetts, New Hampshire, and Florida. The diversified crops, enormous yields from irrigated lands, and the excellent prices for all farm products in the West warrant the assumption that this land will return annually an income larger than the farmers receive in the four states named. For comparison, let us say that the revenues per acre will be the same. It is apparent, then, that this area reclaimed will each year increase the value of farm crops by $60,000,000; it will add $232,000,000 to the taxable property of the people; it will furnish homes for 80,000 families on farms and in villages and towns.

The settlement of the desert will be followed, and in some instances preceded, by the construction of hundreds of miles of railroads, of electric lines, by the development of power for manufacturing and for municipal and domestic use, by a great building movement, and by innumerable investments which accompany the creation of commonwealths. All these will aggregate millions of dollars, assuring employment for thousands of skilled and unskilled laborers, and furnishing a home market for the bulk of the products of the new farms. This immense development of agriculture in the West does not menace the prosperity of the eastern and middle western farmer. Our statistics show that nearly 80 per cent of the desert crops are forage and consumed at home. The products exported are special crops, which are in no sense competitive with eastern grown. The desert's cereal crops do not come east. The Orient has opened wide its doors for desert wheat and barley, for the various forest products, and for the output of western coal mines. Western development means additional markets for eastern manufactured products—cotton, woolens, steel and hardware, boots and shoes, and the high-grade household commodities. With the enormous increase

Power Canal on the Salt River Project in Arizona (see page 221)



Building the Foundation of the Roosevelt Dam in Arizona (see page 225)

in the demand for such articles, the manufacturers will be compelled to enlarge their plants and add to the number of their employees. Such increase will add to the demand for home-grown crops and assures the continued prosperity of the eastern farmers. Thus we see that the eastern farmer and manufacturer are both directly concerned in the work of reclaiming the great American desert. Aside from the fact that the limitless West is the safety-valve against the threatened overcrowding of the East, it is also the treasure chest from which the East may draw fat revenue for all the years to come.

$1,000,000 EXPENDED EACH MONTH

Although only four years have passed since the enactment of the law, the engineers are today employed upon the construction of twenty-five great projects in fourteen states and two territories. The expenditures average more than a million dollars a month. Three of the great projects are practically completed, and six more will be in service this summer. On many of the projects the work goes forward night and day, and the rate of progress is strikingly at variance with that at which government work usually proceeds.

There is, of course, a reason for this. The Reclamation Service is absolutely divorced from politics; it is a business organization and its motive is to build engineering works and to erect an empire in the desert.

The reclamation fund available for the 25 projects now under way amounts approximately to $33,000,000. Before these are completed it will be about $41,000,000. When this has been expended, 1,400,000 acres will have been reclaimed and will begin to return annually $4,000,000 to the fund.

The vast area in these projects and their remoteness from each other make it impossible in one short paper to describe all of these works.

SALT RIVER PROJECT IN ARIZONA

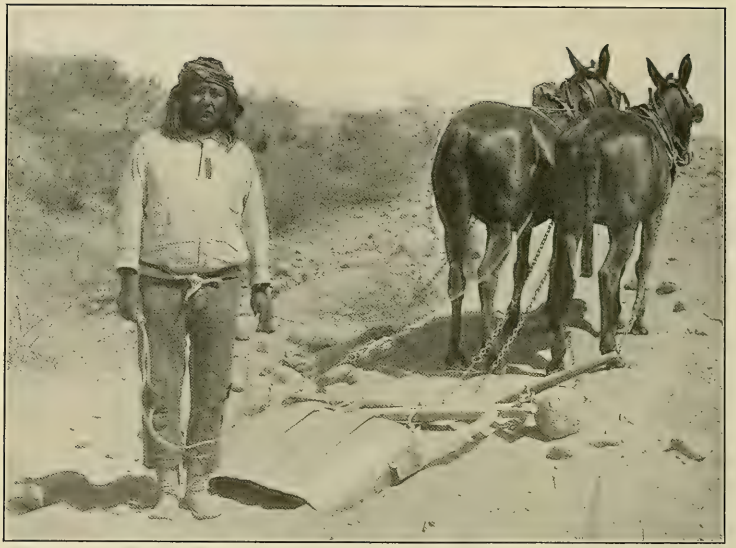
Let us go in fancy to the land of mystery, of lost races and hoary ruins, a land whose civilization was old when Rome was in the glory of its youth—Arizona.

"In that weird land, where the wild winds blowing
Sweep with a wail o'er the plains of the dead,
A ruin, ancient beyond all knowing,
Rears its head."

Antiquity is associated so seldom with things American that most of us confess to an extraordinary interest in the prehistoric on this continent. Owing to the absence of decipherable hieroglyphics and to the few poorly preserved examples of aboriginal workmanship which our ancient Americans have left us, an atmosphere of impenetrable mystery envelops the age in which they lived. Today their ruins stand alone in the desert, and the passage of time is marked in the crumbling walls or in the ancient canals, choked with the wind-swept drift of centuries.

They were the first American irrigators and their works evidence no small skill in engineering. The modern canals of today follow closely the line of their ancient ditches. A splendid compliment to the intelligence of this prehistoric race is being paid by our government in the selection of the valley in which they dwelt for the initiation of one of the greatest irrigation works ever attempted.

No national work under the Reclamation Act has attracted more general interest and none has been more widely advertised by the press than the Salt River project, surrounding the city of Phœnix, Arizona. While the engineering features are stupendous and spectacular, the charm and mystery of the region in which the work is going on appeal even more strongly to the visitor. This is the land of uncorrupted distances, of opal-tinted landscapes and perpetual sunshine. Its atmosphere is one of enchantment and its silence holds a voice of the vanished past.



A Noted Apache Chief employed on the Salt River Project (see page 226)

In the midst of a vast stretch of desert a wonderful oasis has risen, its vivid green standing out in marked contrast with the dusty plain and the distant purple hills. Three fair cities lie in the heart of this emerald island—Phœnix, Tempe, and Mesa. Their future growth and prosperity depend upon the success of the work now going on under the supervision of the Reclamation Service.

Sixty miles away from Mesa a thousand men are toiling night and day to make that growth and prosperity enduring.

Let us now enter the automobile and speed away to those distant mountains, where the silence of ages is being broken by man's machinery. It is early dawn, and eastward the summits of the hills are glowing richly red, their western faces covered with a soft, nebulous veil that trembles in the morning breeze.

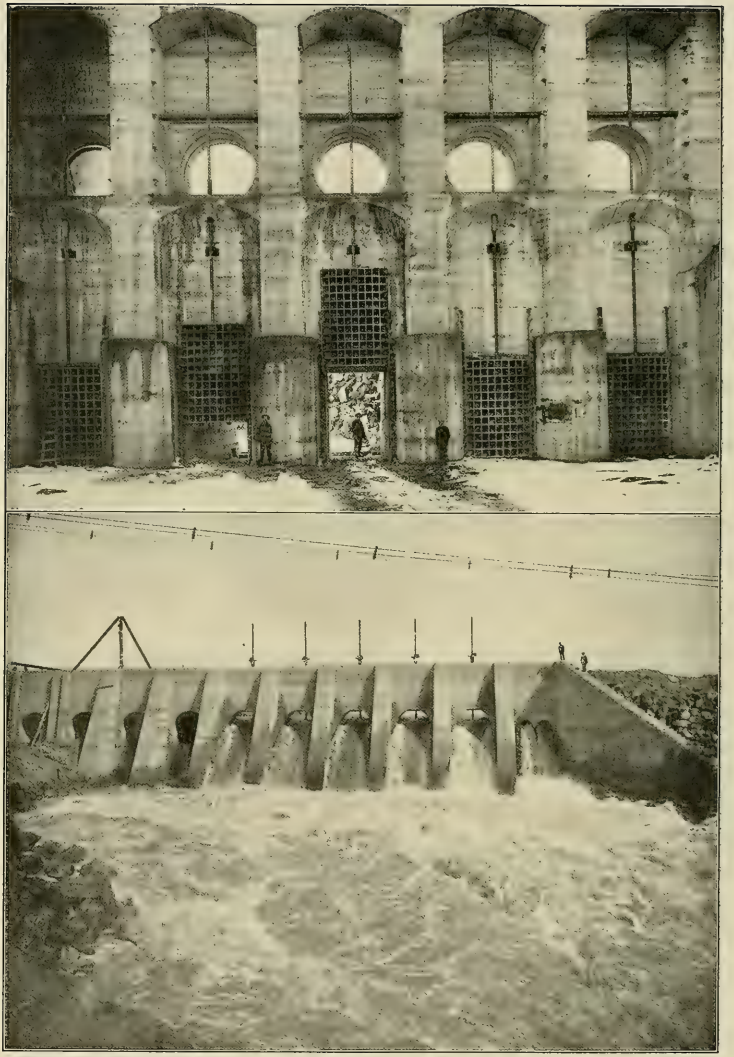
For half a dozen miles we traverse a region of almost tropical luxuriance, where there is a riot of vegetation. Then, with a suddenness that is almost startling, we enter upon a wide expanse of desolation wherein the giant cactus, the gnarled and distorted mesquite, and the dusty green sage-brush are prominent features of the landscape. Every living thing bears mute evidence of a fierce battle for life. For twenty miles the government road stretches out across the plain to the foot of Superstition Mountains, which stand like desert sentinels, immutable and everlasting.

Entering the mountain area, the government road winds by easy grades up the range, affording views on every hand of wonderful beauty painted in marvelous colors.

For twenty miles we journey see-saw fashion, up and down, through a region

Concrete Flume to Carry Water Across the Pecos River, Carlsbad Project, New Mexico (see page 233)

Inside View of the Same Flume. This is the largest concrete flume in America



The Diversion Channel Dam, Upstream Face, taken from bottom of channel and showing the five 8 x 12 coffin gates, Minidoka project, Idaho

The River at Flood Flowing Through the Gates (see page 227)

of scenic wonders, until we reach the summit of Fish Creek Hill. The panorama spread out before us is indescribably beautiful. To the northward the Mazatzal Range culminates in the famous landmark, Four Peaks, 8,000 feet high. Below us a sheer thousand feet lies Frasier's Road-house, where we shall spend the night. The dwellings and stables look like toy houses. Along the edge of that dizzy cliff the road has been literally carved from solid rock. It would be simply terrifying but for the broad and comfortable roadway which we pass over. At the lower end, where Fish Creek emerges from a narrow box canyon, we cross a substantial bridge 50 feet above the stream, and then descend to the little flat on which the road-house is built.

The comfortable quarters, the excellent meals, and the inspiring scenery make this night one of delightful memory. We have slept in a canyon which a short time ago was inaccessible, a miniature Grand Canyon of the Colorado.

The climb out of Fish Creek flat to the government camp above Roosevelt is a repetition of the experience of the day before. Great cuts have been made through solid rock; at places we skirt the edge of dark chasms, at others the road seems to terminate in blind canyons. After a long swing on the brink of a profound gorge we reach the top of the mountain through which the Salt River has cut its way. Here is another inspiring view. Below us the river, like a silver thread, rushes through a deep and shadowy canyon. Looking down through a confusion of cables and wires, we see an army of men at work far below the river bed, laying massive rocks two and three tons in weight in layers of cement. The bedrock has been swept as clean as the floor of a careful housewife's kitchen, and every rock that goes into that structure is washed thoroughly before being set in place. Watchful inspectors hover about, carefully safeguarding every detail of the work.

A CITY BUILT TO BE TORN DOWN

Eastward and northward is a broad flat, across which the Salt River and Tonto Creek flow, to mingle their waters just above the mouth of the gorge. In the foreground is the bustling city of Roosevelt—a city of transient renown, for it was actually built to be torn down—a city well lighted, with its own water supply from distant mountain springs, with schools and stores—all doomed to extinction in a short year.

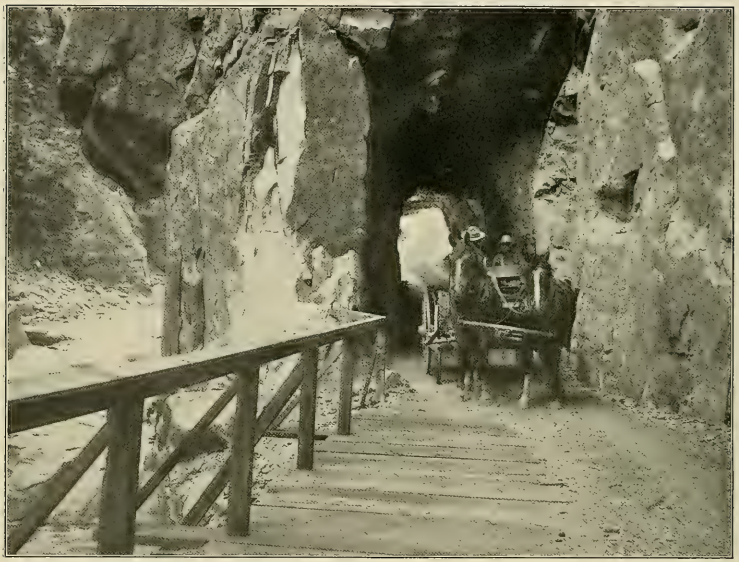
On our right the government cement mill gives noisy evidence that Uncle Sam is a manufacturer. Night and day his plant is grinding out the best cement ever made, and ere the mill has finished its work 240,000 barrels will have been used in the dam. The skips swing ceaselessly back and forth on cables from the mill down to the dam site, carrying alternate loads of cement and sand, the latter from the rock crusher just below the mill.

Several hundred feet below where we stand, in a niche cut in the solid walls of the canyon, is a power plant, utilizing a drop of 220 feet by means of a tunnel and supplying 4,000 horse-power for all purposes. It operates the mill, sand crusher, the machinery for the contractor, and affords electric light for everybody. Its supply comes from a power canal 17 miles in length, in many places lined with cement.

It is a sight never to be forgotten, to stand on this cliff at night and through the myriads of electric globes watch the busy toilers laying the huge blocks of stone.

One of the world's greatest dams is building. A beautiful curve of masonry is slowly rising in the river bed, a masonry monolith against which a turbulent river will beat itself into stillness, its foam and spume lost in a deep lake 25 miles long and 2 miles wide. In that lake the town of Roosevelt will be submerged 200 feet deep.

A quarter of a century ago this particular region was the haunt of Geronimo

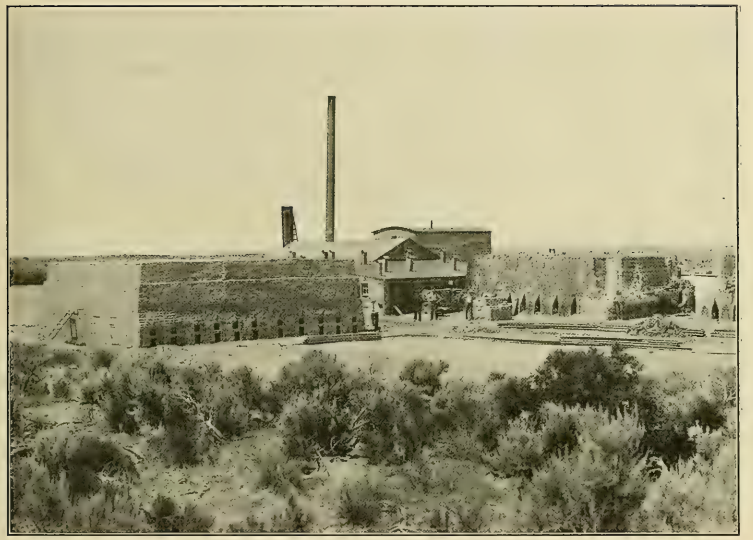


A Tunnel on the Government Road to the Shoshone Dam (see page 223)

and his band of murderous Apaches. The big chief has been exiled, but his people still live here. Owing to the scarcity of labor, the supervising engineer turned missionary and held a pow-wow with the Indians. Such was his eloquence that several hundred Indians went on the government pay-roll. They proved to be good workers and were in no small degree responsible for the prompt construction of the Roosevelt road. Later on they were tried on canal work and on concrete mixing, and were not found wanting. While the head of the family toiled for the government, the squaw in her wickiup wove wonderful baskets, which found ready sale in the camps and in Roosevelt. Poor Lo as a worker is no longer a joke. He has discarded the gay-colored robe, the paint and feathers, and in sweat-shop jumper and blue jeans is earning his living by the sweat of his brow. What justice could be more poetic than that his arrows and hatchets should be turned into picks and shovels and his labor utilized to bring the precious water to the land which he had so often enriched with the blood of the white man.

In 1908 Roosevelt dam will be completed. Its height will be 286 feet. On top it will be 800 feet long. It will create the largest artificial lake in the world and will furnish 200,000 acres of land with water. The cost of the entire project will be approximately $6,500,000.

On several of the projects the work has reached the point where the human interests involved overshadow in importance the engineering features. The most intensely interesting period in the work of reclamation is at hand—the landless man has been brought to the manless land. It has been well said that he who helps to establish the security of the



The Barker Brick Company, Heyburn, Idaho

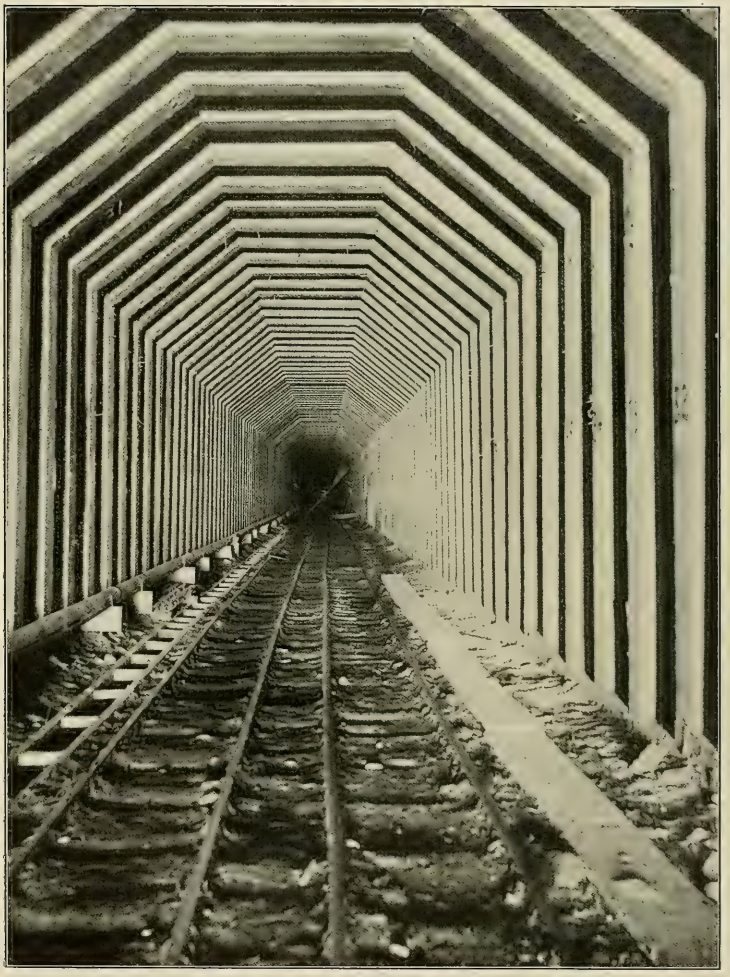
Three years ago, when the government irrigation works were started here, there was not a house within 30 miles (see below)

irrigable home will also help to establish that greater, that composite home, the United States of America. Our nation is indeed affected by this problem which the Reclamation Service is on the eve of solving, for on the success of the irrigable home rests today the prosperity and stability of more than one western state.

A REMARKABLE TRANSFORMATION

In March, 1903, a party of surveyors ran their lines over a vast, unbroken, uninhabited plain in southern Idaho, comprising 150,000 acres of sage-brush. It was a most uninviting and unattractive region. After the surveyors, came the engineers. In turn they were followed by the contractors. The desert's awful stillness was broken by the shrill whistle of engines, by the creaking of giant cranes, and the voices of hundreds of laborers. Attracted by these evidences that Uncle Sam was about to do battle with the desert, scores of home-seekers flocked to the scene and began to erect their homes in the desert. The transformation which has followed the advent of that little band of surveyors is so remarkable that one is led to believe that Uncle Sam, in the rôle of Aladdin, rubbed the magic lamp and the desert vanished.

In 1904 the Minidoka project had not a single inhabitant; today it contains more than 4,000 people; it has three thriving towns, a railway, schools, newspapers. Every eighty acres of that vast desert has a dwelling upon it with a family living in it. Lands only a short time ago counted as worthless are now valued at from $40 to $75 per acre. On August, 1904, a contract was let for the con-



Timbering in the West End of the Gunnison Tunnel.

The government engineers who drove this tunnel won the world's record for the distance driven in one month (see page 234)

The Newly Constructed Government Road Up the Gunnison Canyon

The road in places has grades out of the canyon of 24 per cent (see page 234)

struction of the principal engineering work, a rock-fill dam. This structure was located about 8 miles southwest of Minidoka, at a point where the channel of the river has been crossed by recurring lava flows. A ridge of lava probably extended entirely across the river channel at this point and the river cut a narrow way through it. The purposes of the dam are mainly control, diversion, and power development. In constructing the dam the diversion channel was first built. Two separate masses of fill, the upper one of earth and the lower one of rock, about 150 feet apart, were extended across the river from shore to shore. As the natural channel was thus gradually closed, the water was backed up and compelled to flow through the diversion channel. The line of rock-fill was deposited from a cable-way, the earth-fill being put in place by means of dump-cars and trestle-work. Between the two masses of fill a concrete core wall, built up from bed-rock, was extended across the river. The headworks contain nine gates each 5 feet wide by 7 feet high, and the controlling works contain five gates each 8 by 12 feet. The dam is 80 feet high and 625 feet long; on top it is 25 feet wide. Its volume is about 190,000 cubic yards. It was completed in September, 1906. The natural conditions are favorable for the development of power, and from 11,000 to 30,000 horse-power will be available for the people who dwell under the project, an asset the value of which can scarcely be overestimated. The canal system, to be in operation this year, is more than 100 miles in length and will cover 60,000 acres.

THE WONDERFUL YAKIMA VALLEY

Redlands and Riverside of southern California have their rivals in the Northwest in the wonderful Yakima Valley, in Washington. Those who find the perpetual summer of the Southwest too enervating will be attracted to this remarkable region, which has so recently come into prominence by reason of its surprising fertility and the diversity and superior quality of its products.

Naturally this region was not overlooked by the Service. Today construction is under way which when fully concluded will bring approximately 400,000 acres under ditch. The crop yields in this valley are almost incredible, and, as a result, agricultural lands have as high average value here as anywhere in this country, California orange lands not excepted. Two thousand dollars per acre for orchard land is not an uncommon price. We need not wonder at such sales when these apple orchards frequently yield 1,470 boxes per acre, which sell for $1.25 per box, or $1,737 per acre. The hay crop is an important one. The valley potatoes bring an annual income of $1,000,000 to the farmers. Hops yield from $300 to $600 per acre. Yakima apples and hops sell well in the New York markets, and are exported in large quantities.

The Yakima project is in several units which ultimately will be combined in one great system, embracing 400,000 acres, every acre of which, with an assured water supply, will be worth not less than $100. The government's plans involve an expenditure of about $13,000,000 in canals and ditches and in storage dams to hold back the flood waters of the Yakima drainage in several mountain lakes.

Our desert region is the only section of our imperial country wherein there is an equality of opportunity. In no other part of the nation are the rewards for individual effort more certain and constant. When these facts are more fully realized, the wisdom of President Roosevelt's policy of safeguarding and conserving this vast estate for the people will be appreciated. America has furnished a safety-valve against the overcrowding of the great centers of population in the Old World for 50 years. Is it not about time to look to our problem and prepare against the day when there shall be a glut of population in our own cities? Thoughtful men are predicting a popula-

An Orange Orchard at Riverside, California, the Product of Private Irrigation

tion of 200,000,000 in 1950 and 300,000,000 at the close of the century. How shall we take care of this vast increase?

There is a land hunger even now that is hard to satisfy. Many thousands of our best people are flocking to Canada every year, attracted by the cheap lands of the Northwest Territory. Every acre of our remaining public domain should be reserved for the *bona fide* home-seeker.

WORK IN NEW MEXICO

In the range of resources, in the charm and healthfulness of her climate, and in the fertility of her soil, New Mexico typifies the arid region. It has been found possible for the Reclamation Service to undertake the construction of three projects within her borders.

The greatest of these, the Rio Grande project, is especially interesting, as it involves international and interstate features in unusual combination. The project is today the subject of a treaty with Mexico, and our Congress has just done tardy justice to a friendly neighbor by appropriating $1,000,000 in recognition of a debt long overdue.

The Rio Grande Valley is rich in historical incident. Long before the Puritan fathers landed upon the bleak and inhospitable shores of New England, thrifty husbandmen irrigated the fertile bottoms along the lower valley in New Mexico, Texas, and Old Mexico. Primitive as were their methods of agriculture, they sufficed to sustain a dense population in peace and contentment. Strangely, too, their communal system of farming, with homes in the pueblos and small cultivated areas near by, is essentially being adopted by our later civilization as best adapted to desert conditions. It removes the isolation of the lonely ranch, makes possible social and

A Field of Barley in the Yuma Valley, Arizona, probably the most productive region of the United States (see page 237)

educational advantages, and tends to the economical and most profitable methods of farming. Small farms, carefully and scientifically tilled, make compact communities, which enjoy graded schools and the luxuries and comforts of towns with the freedom and pure air of the country.

The principal feature of this project is the Engle dam, about 100 miles north of El Paso, Texas. It is to be a huge structure of masonry 255 feet high, 400 feet long on the bottom, and 1,150 feet long on the top. This dam will impound 2,000,000 acre-feet of water, or nearly double the amount stored by the Roosevelt dam. It will check the greatest flood ever known on the Rio Grande and will supply 180,000 acres in New Mexico, Texas, and Old Mexico. The estimated cost of the entire project is $7,200,000. One million dollars of this amount has already been appropriated by Congress to meet the proportionate cost of the works required to irrigate the lands in Mexico. These lands were formerly irrigated by canals taken from the river in Old Mexico, but the extensive diversions in Colorado and New Mexico finally rendered these canals useless, and the land went back to desert.

The Hondo project, near Roswell, New Mexico, now almost completed, provides for the storage of the flood flow of the Rio Hondo in a natural depression and supplies 10,000 acres of land.

The Carlsbad project was undertaken by the Service to save from destruction the property of settlers near Carlsbad. A great flood destroyed the irrigation works in the valley, and the valuable orchards and cultivated fields would have returned to desert but for the coming of the government. About 20,000 acres are embraced in this project, which involves an expenditure of $650,000, and will be completed in 1908. It will irrigate a considerable acreage next spring.

IN MONTANA AND WYOMING

There will be an opportunity for homeseekers to secure choice farms in western Montana next summer, when the Huntley project is formally opened. About 35,000 acres are involved in this project and the lands are exceedingly desirable. As this project is in the ceded portion of the Crow Indian reservation, no settlers have been permitted to locate thereon and the formal opening next summer promises to be somewhat spectacular.

Across the line, in Wyoming, is the great Shoshone project, involving several difficult engineering feats. In the narrowest part of the Shoshone Canyon a wonderful dam is beginning to rise above the river bed. In height it tops every other structure of the kind in the world. It will be a narrow wedge, 85 feet across the bottom, 200 feet long on top, and 310 feet high, and will block the canyon. To reach the dam site it was necessary to construct a road through an inaccessible gorge. On this road are several tunnels through rock cliffs, and for several miles the road is in rock cuts. It opens a new and very attractive scenic route to the National Yellowstone Park.

Below the city of Cody, Wyoming, a diversion dam is being constructed in the river, and the stream is to be diverted into a great tunnel three miles long, passing under an elevated plateau. From the lower end of the tunnel canals extending all over the valley will carry the water to 180,000 acres.

TUNNELING A MOUNTAIN—A WORLD'S RECORD

The Uncompahgre project, in Colorado, in many respects has presented more difficult problems than any other work undertaken by the Service. The engineers from the very first step have encountered trouble. The topography of the country is probably the roughest in the United States. Here was a canyon through which no man had ever passed. It was necessary to explore it in order to locate a site for a tunnel. An engineer and an assistant made the attempt, and after incredible hardships succeeded. The topographers who followed to complete

the surveys experienced unheard-of trials, but they too accomplished their task. Then a road into this frightful gorge was constructed—a remarkable road, with grades out of the canyon 24 per cent in places. Heavy machinery was brought in and a power plant was installed. River Portal became a village with a store, a school, a public reading-room, machine shops, cottages, and a hospital. Three crews of men, each working 8 hours a day, were set to work in the canyon, driving a tunnel under a mountain 2,000 feet high. This tunnel is to furnish an underground waterway, with cross-section of 10½ by 11½ feet and nearly 6 miles long, to carry the waters of the Gunnison River into the Uncompahgre Valley. Simultaneously other crews began the same work on the other side of the mountain, and night and day the drills were kept boring into the rock and shale, each crew vying with the other to achieve a record. For a time work was carried on from four headings. The tunnel has been driven 18,000 feet, or 3½ miles, to date. A world's record has been made, 823 feet having been driven in one month. The records on the Simplon Tunnel, in the Alps, do not equal this. One gang of laborers drove over 7,500 feet in one year.

Gas, cave-ins, and subterranean springs have all interposed difficulties requiring the utmost care in the prosecution of the work. While the excavation was going on, many miles of canal have been dug, some of which are in exceedingly unfavorable country.

The Uncompahgre Valley has a general elevation of 5,000 feet, but owing to the lofty ranges of mountains which surround it, the climate is mild and equable. The soil of the valley is of unusual fertility, and this section is noted for its fine fruits.

AN INTERNATIONAL COMPLICATION

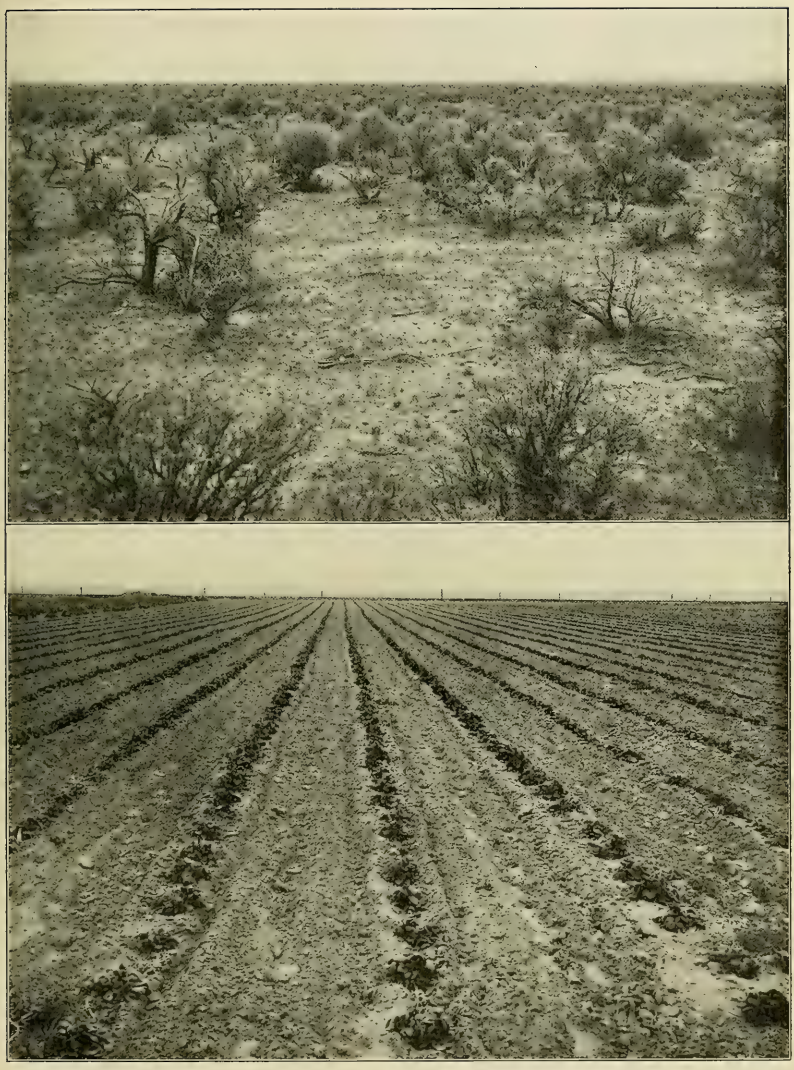
Up in northern Montana, close to the International Boundary, the engineers of the Reclamation Service are wrestling with what is known as the Milk River project. One of the problems on this project is to divert the waters of the stream which rises in this country, but empties into Hudson Bay, and utilize the same on lands in one of our own valleys. There are some rather delicate international features connected with this scheme which the diplomats of the two countries are endeavoring to adjust.

Briefly, the plans provide for the taking of the waters of Saint Mary River across the low divide into the North Fork of Milk River. Milk River rises in Montana, flows northward across the boundary into Canada, continuing in that country for 200 miles, and then turns southward into Montana again, emptying finally into the Missouri River. Our Canadian neighbors are already using the waters of both of these streams for irrigation and an endeavor is being made to settle the questions of water rights. The first work on this project will be the construction of a dam in Saint Mary River near Lower Saint Mary Lake and a canal 37 miles long to carry the water into Milk River. Considerable work has been done on the canal, and on this work a number of Blackfeet Indians have been employed. This region is one of unusual scenic beauty. The mountains are rugged, of great elevation, and contain a number of the largest glaciers in the United States. There are several beautiful lakes and waterfalls in this vicinity.

A UNIQUE PROJECT

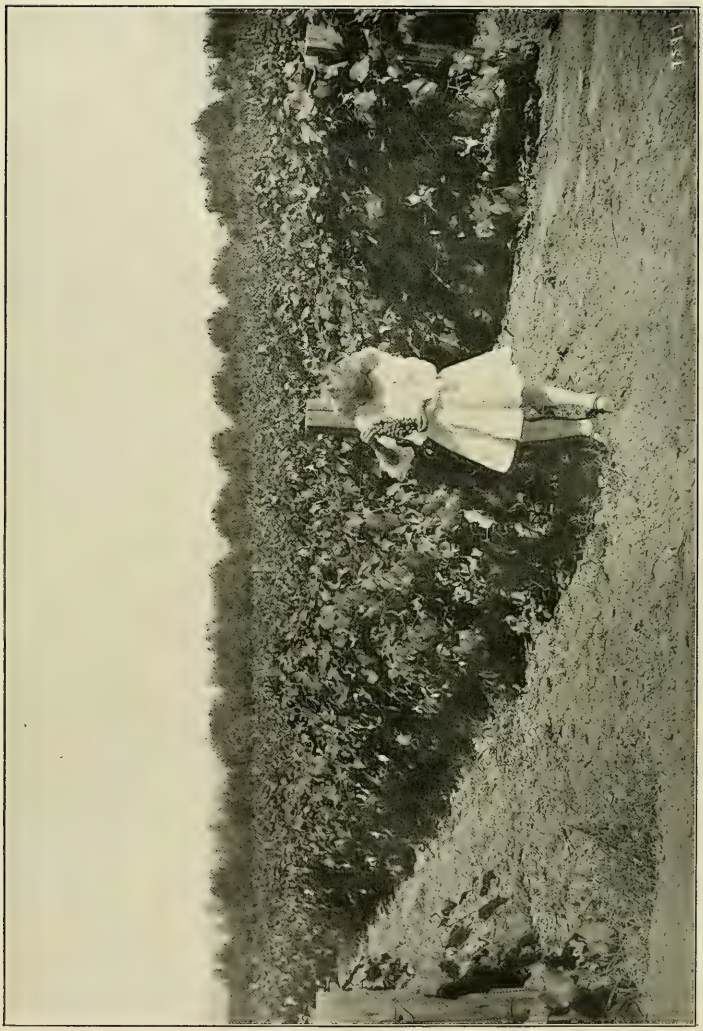
A rather unique irrigation project is located partly in southwestern Oregon and partly in northern California. This is called the Klamath project, and involves problems of irrigation and drainage in unusual combinations. It is proposed to drain partly two lakes and to irrigate their exposed beds from water drawn from Upper Klamath Lake. About 180,000 acres of land will be reclaimed by this project, some 20,000 acres of which will be watered next spring.

The Yuma project, which embraces



Before Irrigation—The Sage Brush Desert, Yakima Valley

After Irrigation—The Same Land Devoted to Strawberry Culture and Valued at $500 per Acre



A Vineyard in the Yakima Valley

First Cutting of Alfalfa on Reclaimed Land—4 tons to the acre—Yakima Valley

lands in California and Arizona, has been the subject of a presidential message to this Congress. This is the region often called the "Egypt of America," and in climate, soil, and crops it bears a singular resemblance to the fertile valley of the Nile. The government is engaged upon the construction of a great dam across the Colorado River about 12 miles north of Yuma. This structure is of the India weir type and is the first of the kind ever attempted in this country. It will have a length of 4,780 feet across stream and will be 19 feet high and up and down stream will have a length of 247 feet. It will be a great mass of masonry resting on the sandy bottom of the river, as no bed-rock was found in the channel at this point. The weight of this structure will be 600,000 tons. Water will be diverted by means of canals connecting with both ends of the dam and the area irrigated will be approximately 90,000 acres. When irrigated this will probably be the most productive region on this continent. Harvests are practically continuous throughout the year, and the yields from well-irrigated lands are enormous.

1267 MILES OF CANALS ALREADY CONSTRUCTED

A summation of the work of the Reclamation Service to January 1, 1907, shows that it has dug 1,267 miles of canals, or nearly the distance from Washington to Omaha. Some of these canals carry whole rivers, like the Truckee River, in Nevada, and the North Platte, in Wyoming. The tunnels excavated are 47 in number, and have an aggregate length of 9½ miles. The Service has erected 94 large structures, including two great dams in Nevada and the Minidoka dam in Idaho, 80 feet high and 650 feet long. It has completed 670 headworks, flumes, etc. It has built 376 miles of wagon road in mountainous country and into heretofore inaccessible regions. It has erected and in operation 727 miles of telephones. Its own cement mill has manufactured 70,000 barrels of cement, and the purchased amount is 312,000 barrels. Its own sawmills have cut 3,036,000 feet, board measure, of lumber, and 6,540,000 feet have been purchased. The surveying parties of the Service have

Cornfield Near Granger, Under Sunnyside Canal, Yakima County, Washington

completed topographic surveys covering 10,970 square miles, an area greater than the combined areas of Massachusetts and Rhode Island. The transit lines had a length of 18,900 linear miles, while the level lines run amount to 24,218 miles, or nearly sufficient to go around the earth.

The diamond drillings for dam sites and canals amount to 47,515 feet, or more than 9 miles. Today the Service owns and has at work 1,154 horses and mules. It operates 9 locomotives, 223 cars, and 23 miles of railroad, 39 stationary engines, and 27 steam engines. It has constructed and is operating 5 electric light plants. This work has been carried on with the following force: Classified service, 380, including Washington office; laborers employed directly by the government, 3,500; laborers employed by contractors, 6,100, or a total of all forces of 10,000. The expenditures now total about $1,000,000 per month. The excavations of earth and rock amount to 33,000,000 cubic yards, or about one-fourth the estimated yardage of the Panama Canal. As a result of the operations of the Reclamation Service, eight new towns have been established, 100 miles of branch railroads have been constructed, and 10,000 people have taken up their residence in the desert.

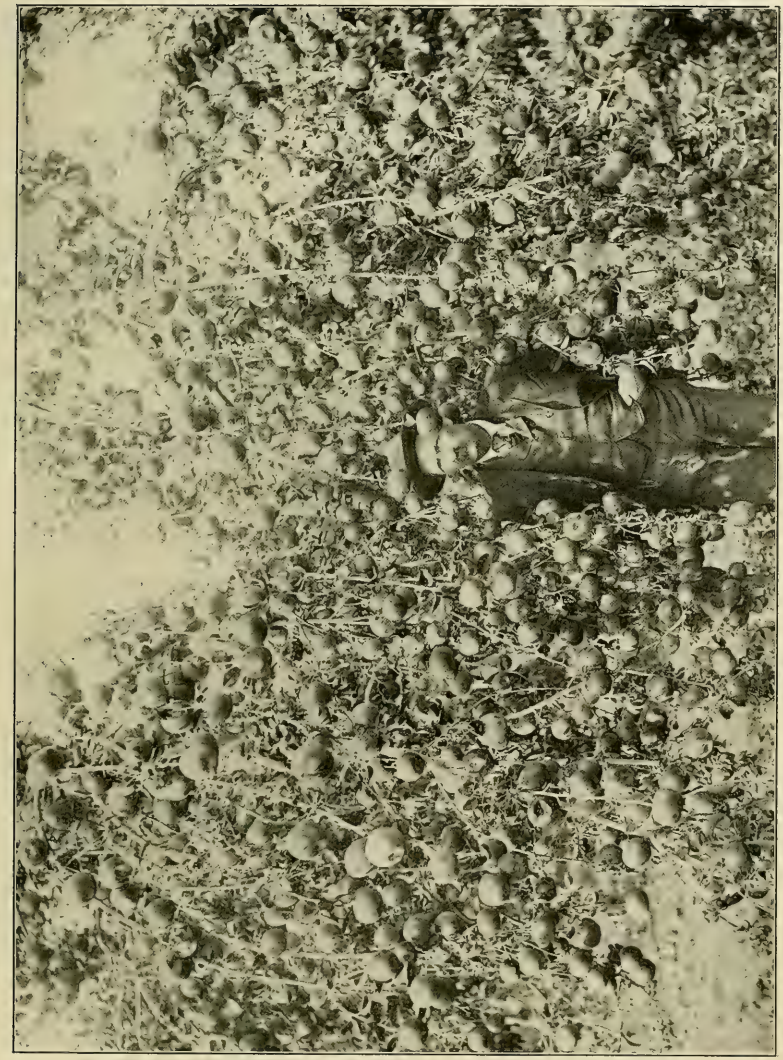
POTENTIALITIES OF THE DESERT

You cannot fix the possibilities of this land of silence and sunshine. Here the harvests are always assured. Here the farmer can estimate by a mathematical calculation the rewards for his labors.

Picking Hops Under the Sunnyside Canal, in the Yakima Valley (see page 230)

The influence of its extended horizon and its true perspective may be potential in character molding and building. Instead of the dead level of mediocrity which prevails where people are overcrowded and underfed, the desert offers the uplift of unmeasured distances, the perpetual sunshine and the individual home of contentment and prosperity. May not these develop new systems of

A Peach Tree on the Fruit and Alfalfa Farm of J. B. Ramerman, near Zellah, Yakima Valley



Apple Tree in the Orchard of Warren L. Gale in the Yakima Valley

A Rick of Apples on the Farm of F. Walsen, Yakima Valley

From a 40-acre orchard the year this picture was taken, 21,000 boxes of choice apples, or 50 car loads of 20,000 pounds each, were obtained. The apples sold at $1.00 per box f. o. b. cars. There are about 600 bushels shown in the rick

ethics and morals, leading us back from the material to the spiritual into ways of gentleness and simple living?

In this empire now asleep, awaiting the coming of the builder, perhaps the dreams of Plato and Socrates, who imbibed their splendid imagery, their stately rhetoric, and their sublime metaphor from the desert, may be revived.

Projects under Consideration and Waiting for Funds to Become Available

Projects.	Estimated acreage.	Probable cost.
Little Colorado, Arizona.	80,000	$4,000,000
Sacramento Valley, Cal..	500.000	20,000,000
San Joaquin Valley, Cal..	200,000	6,000,000
Colorado River, Colorado, Utah, California, Arizona.....	750,000	40,000,000
Dubois, Idaho.....	100,000	4,000,000
Lake Basin, Montana....	300,000	12,000,000
Las Vegas, New Mexico.	35,000	1,500,000
Urton Lake, New Mexico.	35,000	2,000,000
Walker and Humboldt Rivers, Nevada.....	500,000	15,000,000
Red River, Oklahoma...	100,000	4,000,000
John Day River, Oregon.	200,000	10,000,000
Weber, Utah.....	100,000	5,000,000
Priest Rapids, Washington.....	50,000	2,000,000
Goshen Hole, Wyoming.	120,000	4,000,000
Total.....	3,270,000	$129,500,000

Reclamation Projects Now in Process of Construction

Project.	Estimated cost.	Irrigable acreage.
Salt River, Arizona.....	$5,300,000	200,000
Yuma, California-Arizona	3,500,000	100,000
Uncompahgre, Colorado.	5,200,000	150,000
Minidoka, Idaho... ...	1,800,000	80,000
Payette-Boise, Idaho...	1,605,000	120,000
Garden City, Kansas...	260.000	8,000
Milk River, Montana..	1,500,000	40,000
Huntley, Montana.....	900,000	33,000
Sun River, Montana.....	500,000	16,000
North Platte, Nebraska-Wyoming.....	4.100,000	110,000
Truckee-Carson, Nevada.	4,000,000	200,000
Hondo, New Mexico...	336,000	10,000
Carlsbad, New Mexico...	600,000	20,000
Rio Grande, New Mexico.	200,000	15,000
Lower Yellowstone, Montana-North Dakota...	2,700,000	60,000
Buford-Trenton, Williston, Nesson, North Dakota.....	1,270,000	40,000
Klamath, Oregon-California	2,400,000	50,000
Umatilla, Oregon.....	1,100,000	18,000
Belle Fourche, South Dakota.....	3.000,000	100,000
Strawberry Valley, Utah.	1,850,000	35,000
Okanogan, Washington..	500,000	9,000
Tieton, Washington....	1,400,000	24,000
Sunnyside, Washington	2,000,000	40,000
Wapato, Washington....	600,000	20,000
Shoshone, Wyoming ..	3,500,000	100,000
Total.....	$50 121,000	1,598,000

SALTON SEA AND THE RAINFALL OF THE SOUTHWEST *

By Alfred J. Henry

Professor of Meteorology, U. S. Weather Bureau

On February 11, 1907, the break in the Colorado River, which was described by Mr Arthur P. Davis, Assistant Director U. S. Reclamation Service, in the January number of the National Geographic Magazine, was definitely closed for the second time. A lake 440 square miles in area and 80 feet deep has been left.

THERE is a growing belief in the extreme Southwest, and possibly in other parts of the country, that the creation of Salton Sea is, in large part, responsible for the heavy rains of the last two years, not only in Arizona, but also in the Rocky Mountain states, and thence eastward over the plains. So strong is this belief that some persons have gone so far as to publicly advocate the maintenance of the present Salton Sea, notwithstanding the efforts now being put forth to shut off its supply.

Like other popular fallacies, the present one doubtless arose from a careless consideration of the facts in the case, failure to consider whether the supposed cause was capable of producing the observed result, and finally, a misconception of the physical laws under which moisture in the atmosphere is condensed and precipitated as rain.

The facts, so far as they concern the purpose of this article, omitting all general details which are already familiar to the public, are as follows:

As early as October, 1904, there was some seepage water in the depression now known as Salton Sea, but no overflow water. In November, 1904, the Development Company completed a third intake on the Colorado River some miles below the first and second intakes in order to increase the supply of water for irrigation purposes. Soon thereafter a flood wave in the Colorado River scoured out the third intake so that it admitted more water than was needed. The surplus, which at times was very large, naturally sought the lowest part of the depression known as Salton Sink, and in the course of time Salton Sea was formed. It appears, however, that the increase in size of the so-called Salton Sea was gradual, and that it was not until October, 1905, that the total flow of the Colorado River was carried by various channels, mainly the Alamo and New rivers, into Salton Sink.

The rainfall of October, November, and December, 1904, in southern California and Arizona was not out of the ordinary, but beginning in January, 1905, and continuing throughout February, March, and April, an extraordinary amount of rain fell over a belt of country stretching from Florida to southern California, and the region of heavy rainfall also extended into eastern Colorado, eastern Wyoming, western South Dakota, western Nebraska, and western Kansas. With the coming of summer the locus of heavy rains shifted to the states of Nebraska, Kansas, South Dakota, and Oklahoma and Indian territories. September and October were generally dry months, but in November heavy rains fell in Texas, and thence westward to Arizona. December was dry. In 1906 practically the whole of that great region west of the ninety-fifth meridian received more than the normal rainfall, the regions of greatest excess being central and western Kansas, central and western Nebraska, all of South Dakota, Wyoming, Colorado, Utah, and central and southern Califor-

* From The Monthly Weather Review.

nia. The excess in Arizona and New Mexico was not strikingly large.

Considering these facts in proper sequence, it will be observed, first, that Salton Sea was not formed until *after the heavy rains of January, February, and March, 1905*, so that to ascribe the increased rainfall to Salton Sea would be to place the effect before the cause.

Admitting, for the sake of argument, that a body of water of the dimensions of the present Salton Sea existed before January, 1905, let us examine its probable effect on the rainfall of the Southwest. Its present dimensions are approximately 60 miles long, 8 miles broad, and say 25 feet deep on the average. These are rough estimates, but they will serve the purpose. The cubic contents would therefore be $60 \times 8 \times 0.0047 = 2.2$ cubic miles of water.

The normal annual rainfall of Arizona as determined by Section Director Jesunofsky is 11.75 inches. The rainfall for several years previous to 1905 was as follows:

1899	8.4 inches.
1900	8.3 inches.
1901	10.6 inches.
1902	10.3 inches.
1903	9.9 inches.
1904	9.8 inches.
1905	26.6 inches.

From this statement it will be seen that the excess for 1905 was 14.85 inches, an amount more than equal to the normal annual rainfall. An inch of rainfall per square mile is equal to 72,516 short tons. As the area of the territory is 113,956 square miles, the excess in tons for 1905 would be in round numbers $72{,}516 \times 14.85 \times 113{,}956 = 122{,}717{,}500{,}000$ short tons. Converting this amount into cubic miles of water for a comparison of its volume with that of Salton Sea, we have, as before, 1 inch of rainfall on a square mile weighs 72,516 tons. A cubic mile would be this weight $\times 5280 \times 12 =$ 4,594,613,760 tons, or, assuming that the temperature was somewhat above 39° F., say in round numbers 4,500,000,000 tons. The number of cubic miles of rain that fell in Arizona in excess of the average was, therefore, $\frac{122{,}717}{4500} = 27$. This quantity, as may be readily seen, is twelve times greater than the total volume of the Salton Sea. In other words, the total volume of the latter would barely suffice to produce one-twelfth of the surplus rain that fell in Arizona, to say nothing of the rainfall in adjoining regions. The total amount of water now in Salton Sea, if uniformly distributed in Arizona, would cover the Territory to the depth of about an inch and a quarter, or the equivalent of one good soaking rain. How then could the evaporation from Salton Sea, even if it amounted to 8 feet per annum, granting that it was all condensed and precipitated to earth, produce the enormous quantity of water that fell in Arizona in 1905?

As pointed out by Mr Arthur P. Davis in the NATIONAL GEOGRAPHIC MAGAZINE, January, 1907, the advocates of the idea that Salton Sea has caused an increase in the rainfall of the Southwest seem to have ignored the presence of the Gulf of California, a body of water hundreds of times larger than Salton Sea, and distant from Arizona about the same number of miles. This body of water washes the shores of a region probably as arid as can be found on this continent. It has done so for centuries, yet no progressive changes from arid to humid conditions have been observed.

Mr Davis has also pointed out that the disaster which caused the formation of Salton Sea has prevented the normal overflow of the lands in the Colorado Valley below Yuma. The areas of land in that region which would have been overflowed under normal conditions are nearer to Arizona and New Mexico, and of greater extent than Salton Sea, so that if evaporation alone causes rainfall, the tendency of the formation of Salton Sea would have been to reduce rather than increase the rainfall of Arizona and New Mexico.

The obvious deduction from the foregoing is that the Salton Sea is not responsible for the phenomenal rainfall of 1905 in Arizona.

THE INFLUENCE OF SMALL BODIES OF WATER ON LOCAL CLIMATE

It is generally believed that small bodies of water have an appreciable influence on the local climate of contiguous land areas, but it is exceedingly difficult to distinguish between results which may be due to purely local causes and those which may be reasonably due to general causes.

The effect of a small body of water such as the Salton Sea on the climate of the surrounding territory may be recognized in two principal ways, first, in its equalizing effect on the temperature, and second, in the increased amount of water vapor thrown into the air by evaporation, since more water is evaporated from a water surface than from forests or fields. Owing to the fact that a water surface warms up much more slowly than a land surface and retains its heat much longer, the water surface will, in general, be warmer at night than the land and cooler in the daytime. Thus there will be a tendency toward lower maximum temperatures and higher minimum temperatures in a narrow zone immediately surrounding the lake, but especially on the leeward shore.

The distinguishing characteristics of the climate of the Salton Sea region are those of the desert, viz, great heat and dryness. The annual mean temperature is about 77°; winter, 57°; spring, 75°; summer, 97°, and autumn, 79° F. The maximum temperatures of the summer months range from 115° to 130° F., and the minimum temperatures of winter from 20° to 25° F. The annual precipitation is about 2.50 inches, most of which occurs in the cold months. The months of April, May, and June are practically rainless, but occasional showers fall in July, August, and September in about 30 per cent of the years. December and February are the months of greatest rain. In the winter snow may fall, but it rarely lies on the ground more than twenty-four hours; the average number of days in a year with 0.01 inch or more of precipitation is four. The winds of the Colorado Desert are mostly northwesterly in winter and southeasterly to easterly in summer. In the cold season they flow through San Gorgonio Pass, in the northwestern part of Riverside County, elevation about 2,500 feet, as westerly winds, but are deflected somewhat toward the southeast by the San Bernardino Range, which skirts the eastern and northern limits of the desert. Being descending winds and dry, they are not favorable to precipitation. The cold winds are generally from north and east, while rain winds are from east and south. In summer the winds are less stable as regards direction than in winter. While they are largely from the east and south, there is at times a marked westerly component. No record of the diurnal change in the wind for the Salton Sea region is available.

Since brisk winds promote evaporation by constantly renewing the air over the evaporating surface, it becomes important to know something of the force of the wind in the vicinity of Salton Sea. Unfortunately no instrumental records of wind velocity are available for that region, but possibly we may learn something of interest by consulting the records maintained at Yuma, Arizona. At that place high winds are infrequent, yet there is considerable motion in the air during the afternoon and evening hours. Such motion, however, is clearly discontinuous and not calculated to transport air bodily out of the desert region, or to cause the importation of air of different density and moisture from adjoining regions. The particles of air that are set in motion by the winds of the daytime do not move continuously in the original direction, but are carried hither and thither by the light variable airs of the night-time, and in some cases even in a direction contrary to that in which they traveled in the daytime. The

annual hourly velocity of the wind at Yuma is nearly seven miles per hour, 3.1 meters per second, and the range is from an average velocity of three or four miles in the early morning hours to eight or ten miles in the afternoon. At Furnace Creek, in Death Valley, an independent north-south basin, an average wind velocity of 9.9 miles per hour, 4.5 meters per second, was recorded from May to September, inclusive, but here the force of the wind is doubtless augmented by the local topography, and the results are not of general application. In general, it seems reasonable to assume that while there is more or less interchange of air between different portions of the desert, there is no permanent flow of the surface air in any direction except in winter, when the Plateau region is occupied by an area of high pressure. Then the winds blow from the north with much steadiness, so long as the Plateau high exists.

THE VAPOR CONTENTS OF THE AIR

The moisture contents of the winds, especially at Yuma, are surprisingly constant. The north wind, since it descends from somewhat higher levels, is, in general, a dry wind, yet in the winter season the greatest relative humidity of the month may be experienced with a north wind. The moisture contents of the different winds for a winter month (February) and a summer month (August) are shown in the following table:

Vapor Tension at Yuma, Arizona.

(An average of ten years.)

Direction.	February.	August.
	Inches.	*Inches.*
North	0.16	0.57
Northeast	0.20	0.59
East	0.20	0.67
Southeast	0.25	0.67
South	0.21	0.60
Southwest	0.22	0.55
West	0.21	0.56
Northwest	0.20	0.54

The amount of aqueous vapor actually present in the air may be expressed either by the expansive force or pressure that it exerts or by its weight in grains in a cubic foot of space. In the above example it is stated in terms of its expansive force, or barometric pressure, in inches of mercury. Whether expressed in terms of weight or pressure, the amount of vapor actually present is sometimes called the absolute humidity. It is very important to distinguish between the absolute humidity and the relative humidity, sometimes referred to merely as the humidity. The relative humidity is the ratio of the amount of vapor actually present to that which might be present at the existing temperature if fully saturated: Example from Death Valley, June, 1891, temperature of dry bulb, 108° F., wet bulb, 68° F., whence is obtained from hygrometric tables: dew-point, 39° F., relative humidity, 10 per cent. The observation quoted means, first, that in order to condense any of the moisture present into dew or rain the temperature would have to fall 69° (from 108° to 39° F.), or the amount of moisture then in the air would have to be increased tenfold. This point cannot be emphasized too strongly. At the temperatures which exist in the Colorado Desert, and under the general conditions of aridity which prevail, the atmosphere takes up vapor as a sponge absorbs water. It should be remembered, moreover, that the capacity of the air for vapor is vastly greater at high than at low temperatures; the problem in the Southwest, therefore, so far as the production of rain is concerned, is not essentially one of increasing the vapor contents of the air, but rather of diminishing the temperature to the point at which condensation takes place. There is sufficient moisture in the air to produce abundant precipitation if means of cooling it were at hand. The absolute humidity at Yuma is slightly greater than that of St. Louis, and only a little less than that of Vicksburg, both of which points have, in general, an abundance of rain and a so-called moist atmosphere.

The amount of vapor taken into the air over Salton Sea must be considerable in the course of a year, but to adduce definite and satisfactory proof that it has increased the rainfall is a very difficult problem. That it has increased the relative humidity in a slight measure is undoubtedly true. Aqueous vapor in the absence of a strong wind circulation is diffused very slowly throughout the atmosphere. It is, therefore, improbable that any considerable portion of the local supply of vapor ever passes beyond the immediate confines of the desert. The writer knows of but one case where there is a reasonable presumption that the local evaporation has increased the rainfall, and the increase in this case amounts to but two or three inches annually over the area whence the evaporation proceeds.

WOMEN AND CHILDREN OF THE EAST

The Little Black Brother

A Tamil child in everyday costume of silver and gold. The after-dinner pose

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THE following illustrations were made and collected by Eliza R. Scidmore, Foreign Secretary of the National Geographic Society; author of "Jinrikisha Days in Japan," "Java, the Garden of the East," "Winter India," "China, the Long-lived Empire," etc., etc., and are here given to show something of the personal side of the people of the East.

The Far East is a constant source of wonder and fascination to westerners. The marvelous architectural triumphs of India, Burma, and Siam, displayed in gorgeous temples and enormous rock-hewn edifices, and the delicate artistic skill of Japanese carvings, pottery, and tapestries excite our admiration and respect; but after all it is the men, women, and children of these countries who appeal to the traveler most strongly. Miss Scidmore has passed many years in the East, and the special facilities which have been given her on account of her sympathetic appreciation of the best in oriental character have enabled her to obtain unusual photographic impressions of the people.

A knowledge of the people of other lands is as essential to the success of a nation nowadays as the understanding of human nature is essential to the success of an individual. It is believed that this series have much educative value and are worthy of considerable study.

Cingalese Children

The little children have no need of other clothing than a few necklaces in their greenhouse home of Ceylon. As an extra decoration the little black brother has usually two vaccination marks on his arm

Mother and Child—Ceylon

The Dutch or the Portuguese gave the Cingalese women the decolletee jacket they wear in combination with the native sarong. Silver or coral beads show with telling effect on their very black necks, and the little black babies ride astride of the mother's hip with easy grace

Tamil Woman in Ceylon

With a red pottery jar on her head, a white sari with broad red border and a few silver bracelets, the Tamil woman is as graceful a figure as ever seen in Greek friezes, and if she only stops to gossip with a figure from another frieze, seems delicately posing for some one to sketch or photograph her with a cacao tree for background

Cingalese Children

The older sister is as much a little mother in the tropics as elsewhere, and the cool drinkis always in demand by thirsty man, whatever his size may be

Little Tamil Girl

Instead of the savings bank or the buried pot, the Hindu puts his wealth into jewels and gold coin, and ornaments his women with tangible riches, where they are always under his eye and can be counted. For weddings, the jewels are often hired by both families, and children of the slums wear eight and ten necklaces, the bracelets and jewels of a temple idol for one day only

Tamil Girl's Foot and Ankle

With bells on her ankles and rings on her toes, the dancing girl does not need cast and accompaniments to her dreary measures

Buying the Goldfish—Japan

Toda Mother and Child

The Todas are a wild hill people of southern India, occupying the Nilgiri Hill region near Madras, where the famous resort of "Ooty," or Ootacamund, is situated, 7,000 feet above the sea

Street Dancers—Delhi

The dancing women, who go about Indian streets carelessly veiled, and who come to the portico of the hotels to dance for a few coppers, are often more picturesque and attractive than the jeweled dancers at palace entertainments. These two Delhi dancers wore only coarse yellow and red cotton clothes, their jewels were necklaces and bracelets of silver rupees and ornaments of cheap imitation of rubies, pearls, and emeralds, but as color studies they were admirable. They did a skirt dance, ages old in India, without the aid of colored lights or glass floor

Street Dancers of Delhi

Bridegroom's Palki in Wedding Procession at Jeypore

The ten-year old bridegroom, in cloth of gold turban, coat covered with jewels, rides in a palki, suspended from a silver arch or yoke, hung with red velvet and silver tassels. The body of the car is all tinsel and silver and velvet, and carried by coolies of the shabbiest clothing. All the family, in all the finery they own or can hire, attend the parade through the streets, and singing and dancing girls give performances whenever the procession halts

Camels in the Khyber Pass

Caravans of two and three hundred camels in line go up and down the Khyber Pass all of the two days in the week that the famous defile is open to general travel, and guarded by troops. The camels bring down silk, dried fruits, grapes, and spices from Cabul, and take back all sorts of European goods and Indian products from Peshawur's bazars. The strangest thing we saw was a baby camel with the long neck and goggle eyes of a young ostrich, securely tied in the saddle-bags on its mother's back as it journeyed toward Afghanistan

A Gwalior Madonna

The Cry of the Famished, Gwalior

The Twin Babies of Nikko—Future Soldiers of the Empire

Nothing so diverts the newcomer in Japan as the babies on the backs of mothers and older children. If one baby riding pig-a-back is quaint and funny, twin babies are more than twice as droll

The Twin Babies of Nikko

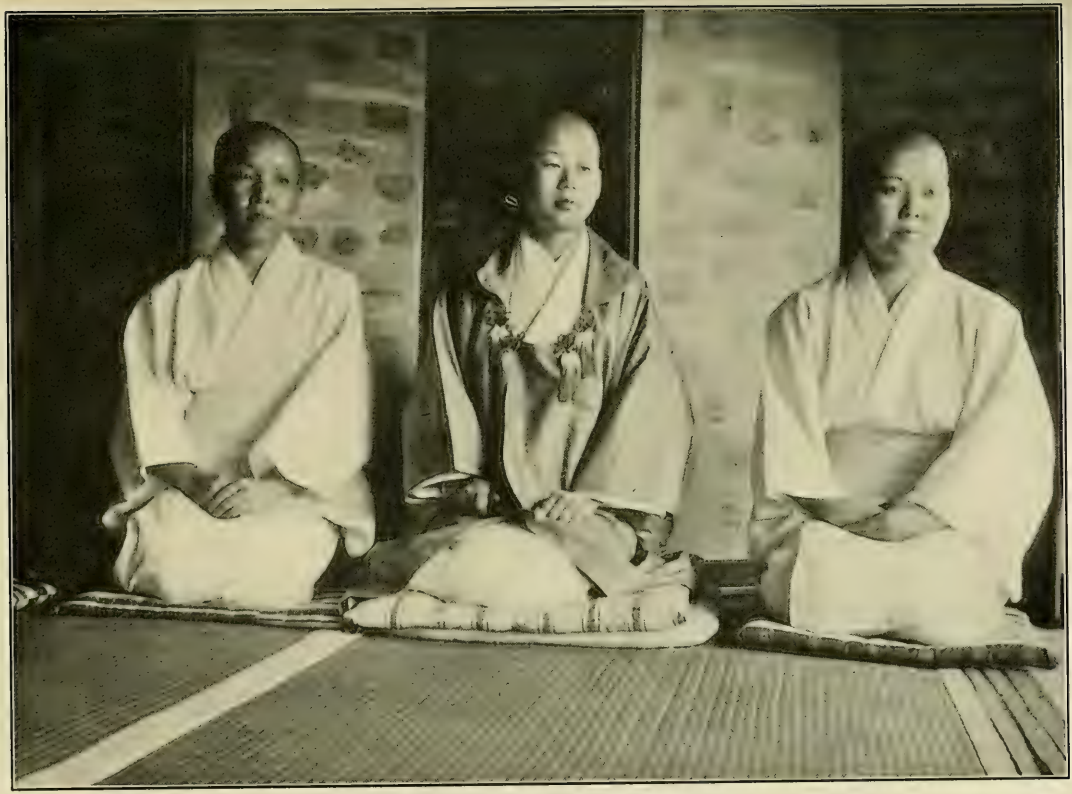
The twins were a sturdy little pair, and even when they were a year old, their mountain mother thought nothing of tying them on her back and walking two miles

For the Emperor's Soldiers in Manchuria

Immediately upon the opening of the war, all the women of Japan set themselves to preparing comforts for the soldiers at the front. Even school children knit stockings, mittens and bands, and one often saw these accomplished people holding the skein of yarn with their feet, as in this picture, while they wound the ball with their hands

Old Age in the Sunshine

The wrinkled old woman has carried her mat and her sewing-stand out from the house and sits by the roadside to do her mending



A Group of Buddhist Nuns—Japan

The Buddhist nuns wear white garments and shave the whole head. They perform mass, care for the altar, and do all the temple offices of priests. They may go about freely, and are often met at places of pilgrimage

The Lady Abbess of Hokkeji Convent, Nara

Feeding the Storks, Okayama Castle Garden

Javanese Mother and Child

The Javanese baby rides astride of its mother's hip, like the Hindu baby, but its weight is supported by the *slandang*, a scarf of *batlek*, or painted muslin. It lies comfortably in this cotton cradle able to sleep and relax without any attention from the mother, who has both hands free for work

From "Java, the Garden of the East," by Eliza R. Scidmore. Copyrighted by the Century Co.

Painting Sarongs in Java

The *sarong*, or Javanese petticoat, is a straight piece of *battek*, or painted cambric, one yard deep and three yards long, sometimes sewn up and left like a bag, with both ends open. It is drawn smoothly over the hips and the fullness gathered in a knot, that by a deft twist is made self-fastening. English cambric is the material used, and the patterns, in a rich dark red, brown, and blue, are applied from a tiny funnel with a needle-sized opening that distributes the hot dye in hair lines, if needed. Geometrical design and natural forms, highly conventionalized, are the motifs of the unique ornament

King and Queen of Burma

King Thebaw of Burma and his blood-thirsty Queen Soupayalat, who brought about his downfall in 1885 and the annexation of Burma by England. The royal pair are framed in one of the wonderfully carved teak entrances to the Shive Dagon Pagoda at Rangoon

Manchu Lady and Her Son

The long Manchu gown reaching to the feet and the short overjacket make that costume the most dignified and becoming of any in China. The broad hairpin, wound with strands of satin-smooth black hair and finished with great bunches of flowers, is a most becoming headdress, and when covered with jewels and hung with twelve inch tassels of pearls, as for the imperial princesses, the result is more splendid than that of any tiara, coronet, or crown

Siamese Prince in Full Regalia of Jewels

There is no age limit to the wearing of jewels in the gorgeous East, and baby princes, clad in a mail of gold brocade crested over with pearls and colored stones and glittering with pin points of diamonds from cap to toe, are fit occupants of jeweled thrones

Siamese Woman in National Dress

The people of Siam cling to their native dress, and prince and peasant, men and women alike wear the *panung*, which is the Malay *sarong* drawn up between the knees and tucked in the belt until it looks like a pair of very full knickerbockers. Princes wear military jackets and long silk stockings with the *panung*. Ladies of high degree wear Parisian blouses with the *panung*, while the women of the people adopt the loose Chinese jacket or retain the native scarf over the shoulder like this figure

NOTES ON CENTRAL AMERICA*

THE area of Central America is a little larger than that of California, with a population of about 4,300,000. Though it lies wholly within the tropics, it is only the belts adjoining the oceans which have torrid climates. The high lands of the interior, five and six thousand feet above the sea, could have been no more effectively situated in a temperate zone.

The general superficial appearance of Central America may be said to be—save on the Caribbean Sea coasts, where it is low and level—that of a region of forest-clad hills, fertile valleys, large lakes, and small rivers. All the capitals are in the interior, and are situated generally at an altitude of from three to five thousand feet, where the climate is cool and salubrious; the seaports connecting with the capitals are small, hot, and unhealthy.

A chain of active volcanoes extends through Guatemala, Salvador, and Nicaragua, several of which, notably Santa Maria, in Guatemala, have had violent eruptions during recent years. This section is also frequently visited with destructive earthquakes.

Within a few months Central American travelers will be able to go from New York to Guatemala City by rail, as the few railway gaps in Guatemala and Mexico are being rapidly filled.

A Comparison of the Central American Republics

Republics.	Population.*	Area in square miles.	Annual commerce in gold dollars.	Miles of railways.
Guatemala	1,842,134	48,290	$12,600,000	500
Salvador	1,006,848	7,225	14,000,000	1 0
Costa Rica	331,140	18,400	12,300,000	340
Nicaragua	420,000	49,200	1,250,000	200
Honduras	744,901	46,250	4,500,000	100

* *Guatemala.*—About 60 per cent of the population are pure Indians, most of the remainder being half-caste. The foreign population numbers about 15,000.

San Salvador.—Aboriginal and mixed races form the bulk of the population, the latest census returns giving 772,200 Mestizos, and 234,648 Indians.

Nicaragua.—The bulk of the population consists of Indians, mulattoes, negroes, and mixed races.

Costa Rica.—The population is nearly all white.

Honduras.—The bulk of the population is Indian.

The capitals, with the populations, are as follows:

Guatemala City	100,000
San Salvador	60,000
San José	24,500
Managua	30,000
Tegucigalpa	35,000

NICARAGUA

The development of Nicaragua during the last decade has been most gratifying to the friends of the country. Given a remarkably rich territory of nearly 50,000 square miles and a population of a little over 400,000, the field for successful enterprise is great indeed. The prosperity of the country is mainly due to the administration of President José Santos Zelaya, who now for twelve years has been at the head of affairs in Nicaragua.

When General Zelaya first came into power there were only 90 miles of railroad line. Now the mileage is double that figure; but what counts for more is that the work now under way, when completed, will assure through communication from the Pacific to the Atlantic. The surveys for this transcontinental line have been completed, several miles of track have been laid, and much grading in addition has been done.

* For further information the following authorities are recommended:

The Hand Books on Salvador, Costa Rica, Honduras, Guatemala, and Nicaragua, published by the International Bureau of American Republics, Washington, D. C.

"The Capitals of Spanish America," by William E. Curtis. Harper and Brothers.

"In and Out of Central America," by Frank Vincent. D. Appleton & Company.

"The Report of the Inter-Continental Railway Commission," 7 volumes, published by the Commission, Washington, D. C.

"Guatemala, the Country of the Future," by C. M. Pepper, Washington, D. C.

Also the various reports of Messrs C. M. Pepper and H. G. Davis, of the Inter-Continental Railway Commission.

Outline Map of Central America

Surveys have been made for a railroad line to Matagalpa, in the center of the coffee district, where there are many Americans. From this line branches to the Rio Grande, Prinzapolka, and other districts are to be built.

For the encouragement of immigration, in addition to the railroads, the government is giving considerable attention to the improvement of the highways. This is in pursuance of the policy of opening up the interior. A recent official report shows that 1,100,000 acres of public lands have been taken up.

In President Zelaya's recent manifesto, reviewing the state of the country since 1893, an outline is given of what has been accomplished by his administrations. Political rights stand today on a broader basis; the people of all social classes share in the government. Religious tolerance is established, and *habeas corpus*, non-sectarian instruction, protection for inventors and authors, a genuine system of municipal self-government, and a wide extension of political rights are among the other advantages Nicaragua enjoys under this progressive administration.

The principal agricultural products of Nicaragua are bananas, chocolate, coffee, indigo, corn, sugar cane, rice, and tobacco. The timber possibilities are considerable. Cattle raising is becoming an important industry. The country has extensive mineral resources.

HONDURAS

In Honduras there is no farming on a large scale, and such large plantations as are now under cultivation are chiefly along the north coast and under the direction and management of foreigners. It might be assumed that Honduras, with its varied climate, its lowlands and highlands, and undulating plains in all parts of its territory, covered with rich, fertile soil, would be essentially a great agricultural region. The situation is quite

the reverse. The native rarely raises a greater crop of corn, beans, and rice than will suffice for his needs until the following crop can be garnered. It is sometimes extremely difficult to obtain bananas, oranges, potatoes, and even corn in Tegucigalpa.

Very few fields are properly plowed, and the care bestowed on the growing corn, wheat, red beans, or sugar cane amounts almost to nothing. As it is, the ground is often so extremely fertile that the mere insertion of the kernel of corn in the earth gives the desired result, without further effort. Great areas of the mountain sides near the summits are cleared by burning down the brush and trees. The seed is planted by dropping it into the hole and covering it up with the foot. The prevalence of clouds and mist high up in the mountains, and the long duration there of the sunlight warmth, together with the richness of the soil, contribute to simplify the labor of farming in Honduras. Corn is the chief article of food, the cereal being ground and used in many ways for man and beast. Two crops a year are secured, but with this advantage and the large demand from the towns there never seems enough maize by half. Maize is grown in every part of Honduras. The same may be said of sugar cane and the red bean (frijole). Tobacco and coffee are raised chiefly in the mountainous districts of the western and central departments.

Honduras is the richest of the five Central American republics with regard to mineral resources. The development of her mines can only be effected, however, by wise and economic methods and the opening of new and cheap transportation lines.

Throughout Honduras there are vast forests covering the mountains and filling the plains. Nearly all the varieties of pine flourish here, the yellow and long-leaf pitch pine predominating. Very little of this timber is being cut or sawed for building purposes, and in order to export it in commercial quantities roads and other means of transportation must first be inaugurated.

Mahogany and cedar flourish near the oceans, and form one of the principal exports. The wood of these trees is obtained through government concession rights, generally for a period of years and at stipulated prices per tree.

In the forests are to be found rubber trees, which in numerous instances have been so recklessly tapped and scarred as to destroy their usefulness entirely.

Sarsaparilla and vanilla grow in great abundance in these tropical forests, and the product is gathered only by natives, who sell it to the exporting houses at the various ports.

The pita, called in Mexico ixtile, is a variety of agave, very prolific, and yielding fibers varying in quality from the coarsest hemp to the finest flax. It is used in the manufacture of thread, cordage, hammocks, paper, etc., and, being hardy and easily cultivated, may be made an important article of export as well as of domestic use.

SALVADOR

The republic of Salvador is the only one of the five Central American republics not having a coast line on the Atlantic. It is the smallest and most densely populated of the Central American republics, having an area of only 7,255 square miles. The frontage on the Pacific is 139 miles in length. The physical aspect of Salvador is very varied, but chiefly mountainous. On its northern frontier, and near the boundary line of Honduras, stretches the great mountain chain of the Sierra Madre, or Cordilleras, many of the peaks of which rise to a height of from 7,000 to 8,000 feet above the level of the sea.

COSTA RICA

The population of Costa Rica is nearly all white, and mostly descendants of Spaniards from Galicia. The Indians are not numerous, and are completely dis-

tinct from the civilized race. The negroes and mixed breeds live almost exclusively on the coast lands.

The Costa Ricans are all well formed, robust, and healthy people, with regular features. The women are gracious, have splendid eyes and abundance of hair, and appear affable in manner. The men are intelligent, industrious, economical, honest, and peaceable, as well as polite, truthful, and generous. They respect order and property, love to work, and are proud of their wealth and of the independence of their nation.

Every Costa Rican owns property of some kind. The better class of women follow in their dress the fashions of Europe; the lower classes have gowns of muslin or calico, and wear petticoats, rebozos, and very often Panama hats. Some adorn themselves with earrings and other jewelry, and some wear shoes.

The men dress in European style. The lower class, consisting of hard-working farmers, owners of small coffee plantations and ox carts and oxen for internal traffic, wear coarse cloth coats, drill or cotton trousers, and straw or felt hats. Most of these people go barefooted.

The houses of the wealthy have all modern conveniences. Those of the poorer classes are nearly comfortless. They are mostly low and built of adobes, with a roof of tiles, and are arranged in regular streets crossing each other at right angles. The public buildings are spacious and ornamental.

Among the principal buildings in San José are the New National Theater, in which about 1,000,000 pesos was invested; the National Palace, the Palace of Justice, the Executive Mansion, the Episcopal Palace, the National Distillery, the Market, the University, the High School for Young Ladies, the High School for Young Men, the Custom-house, the Mint, etc.

The city possesses charitable institutions, such as hospitals, orphan asylums, insane asylums, etc., all under the management of corporations and associations constantly laboring for their improvement. The cemeteries are under the supervision of charitable associations. There are several parks, a museum, a public library, and scientific, legal, medical, literary, and musical societies, an international club, and a German club, etc.

The streets are mostly macadamized or paved with stones and lighted by electricity. Nearly every city is well supplied with water, conducted through pipes.

The food of the poor comprises meat, beans, corn, rice, tortillas, and plantains.

Saturday is the especial market day of the cities, and from sunrise till noon the market places are crowded with sellers and buyers. Here can be found all kinds of vegetables and fruits—potatoes, corn, beans, coffee, tobacco, sugar, cheese, meat, and other food, besides earthenware, hammocks, hats, rebozos, charcoal, etc.

The population of Costa Rica is estimated to be 330,000, of whom about one-third, or 31.42 per cent, are able to read or write.

GUATEMALA

Guatemala, writes Charles M. Pepper, is a fascinating country for the traveler and visitor. Antiquarians, deep delvers in the majestic monuments of the long-forgotten past, seek in the myths, the traditions, the temples, and ruins the riddles of prehistoric civilization. Modern tourists, traveling, as they will be able to do within a short time, by railway from New York or San Francisco to the very heart of Guatemala, may lose themselves in admiration of the sublime scenery, the lovely landscapes of valley and mountain, lake and forest (the Indian name for Guatemala means abounding in trees), volcanic caps, giant outlines, and cloud-clad craters. Everywhere they will encounter that diversity which is the chief attraction of natural scenery. They will find also superimposed on the prehistoric Indian civilization the charm of Spanish

Native Types—Honduras

architecture, customs, character, and institutions.

Men of the stamp of President Estrada Cabrera, who are engaged in the material upbuilding and the political progress of the country, may prefer to talk of its agriculture and commerce, its opportunities for the energetic and resourceful people of the northern regions, rather than to discuss its picturesque ruins and its fascinating history. Yet they would not have these subjects neglected. Hence the traveler and the tourist always are welcome, and whether they be deeply learned scientific investigators or mere birds of passage seeking novelty, every provision is made to aid them in their travels.

A FAMOUS SPANISH CAPITAL

Mr William E. Curtis, in his interesting book, "The Capitals of Spanish America," gives the following description of the great city built by the Spaniards:

"Antigua, as it is now called (properly old Guatemala), was not only the scene of wealth and influence and the commercial metropolis of the country, but the home of the most learned men of all Spanish America; the seat of great schools of theology, science, and art; for two hundred years the Athens and Rome of the New World; the residence of the university as well as the inquisition, and the headquarters of those untiring apostles of evil, Jesuits. The population is said to have been about one hundred and fifty thousand. It is not known that a census was ever taken, and this estimate is based upon the size of the city and the number of inhabitants its ruined walls could have contained. It is situated in the center of a great valley, between the twin volcanoes Agua and Fuego, and, as the old Spanish chroniclers used to say, had Paradise on one side and the Inferno on the other. The beauty of its position and the richness of the adjacent country, the grandeur of the scenery that surrounds it, have called forth the most extravagant admiration from travelers, and have made the theme of the native poets."

In 1773 a fearful earthquake destroyed the city, leaving "the most extensive collection of ruins that can be found in this hemisphere. From a tower of the cathedral one can see on either side the ruins of many churches, monasteries, convents, and miles of public and private residences, large and costly, some with walls still standing, liberally ornamented with stucco or carved stone, but roofless, without doors or windows, and trees growing within them.

"The ruins of forty-five churches can be counted, and nearly every one of them had a convent or monastery attached. Some cover several acres, and have cells for five or six hundred monks or nuns. Several of the churches are as large as the cathedral in New York."

BRITISH HONDURAS

In his annual report for 1906, U. S. Consul W. L. Avery, of Belize, writes as follows of conditions in British Honduras:

"The year 1906 has been one of progress, prosperity, and freedom from pestilence; sanitation and rigid quarantine having freed the colony from the yellow fever scourge of 1905, and though the actual death list in that year was small, the depression and material loss were deplorable. The health of Belize and of British Honduras was better in 1906 than for the years preceding 1905. The three great needs of this colony are sanitation, transportation, and cultivation, and the trade conditions will be vastly bettered as these are advanced. Sanitation is nearly perfect in the towns where screening receptacles for water, the filling of swampy lots, and a thorough and continuous cleaning of streets, yards, and drains have resulted in the sound health conditions now enjoyed. Transportation by motor boats on the rivers, new wagon roads to the plantations, and the money voted for a 20-mile tramway from the town of Stann Creek to the Crown lands westward show that industrial needs have received attention. In cultivation and the new acreage devoted thereto the greatest

progress has been made. The application of the United States Fruit Company to purchase 15,000 acres in Stann Creek district for banana planting and the clearing and development of similar areas of 1,000 and 2,000 acres on the Sittee, Temash, and other rivers will result in steamers being able to load entire cargoes in this colony, perhaps in 1907, something they have never been able to do in the history of the fruit trade.

PUBLIC IMPROVEMENTS AND AMERICAN GOODS

"The connection of the Colonial and Mexican telegraph systems has proved satisfactory, and communication has been almost constant. Two years ago telegrams were received by mail, three days *en route* from New Orleans. On May 1, 1906, electric light was used for the first time in Belize. The plant and installation are American.

"The $36,732 worth of machinery imported into the colony is accounted for by electrical demands and the growing popularity of the gasoline motor. There are over thirty motor boats in British Honduras. The longest route, of 140 miles, Belize to Cayo, is now covered in thirty-six hours, the best former time having been five to seven days.

"The United States supply this market with about all packing-house products imported.

"The mail service, Belize to New Orleans, is weekly, and the contract with the United Fruit Company that expired in December has been renewed for five years, with the subsidy of $12,000 per annum, as before. The exports to the United States in 1906 were of the declared value of $817,192, and consisted of the following articles:

Articles.	Value.
Bananas	$178,608
Cocoanuts	85,250
Chicle gum	250,895
Cedar	12,738
Hides	2,237
Logwood	7,042
Mahogany	238,277
Plantains	12,756
Rubber	24,097
Sponges	2,923
Other articles	2,369
Total	$817,192

"The total imports were valued at $2,019,000, of which the United States furnished $1,008,000 worth."

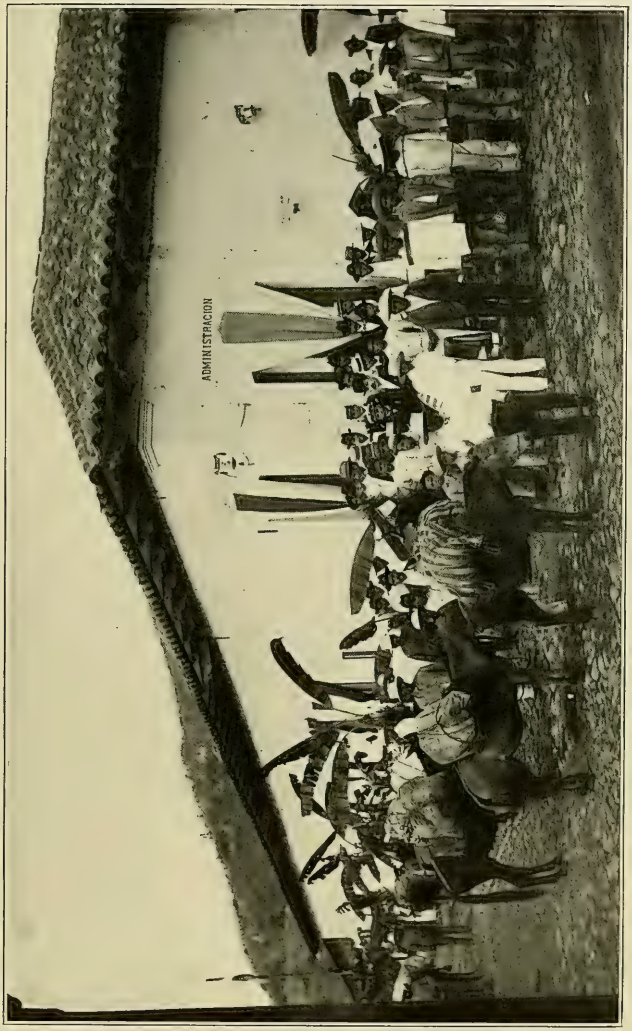
OUR SHARE IN THE COMMERCE OF CENTRAL AMERICA

The following tables are interesting as showing the total annual commerce of Central and South America, and the share therein of the United States:

	Imports.	Share from United States.	Per cent.
Mexico	$84,487,000	$47,530,000	56
Central America	18,080,000	7,733,000	42
South America	444,014,000	58,944,000	13
Total	$546,581,000	$114,207,000	20

	Exports.	To United States.	Per cent.
Mexico	$96,962,000	$65,095,000	67
Central America	25,038,000	10,205,000	40
South America	629,869,000	136,488,000	22
Total	$751,869,000	$211,788,000	28

	Total commerce.	Share with United States.	Per cent.
Mexico	$181,449,009	$112,625,000	62
Central America	43,118,000	17,938,000	41
South America	1,073,883,000	195,432,000	19
Total	$1,298,450,000	$325,995,000	25



Mail Carriers and Mule Train Leaving Post-office, Tegucigalpa, Honduras

The Giant Spider Crab from Japan

This fine specimen of the largest of all Crustaceans, the Giant Spider Crab, *Kæmpferia* (*Macrocheira*) *kæmpferi* de Haan, which measures somewhat over 12 feet between the tips of its outstretched claws, has recently been placed on exhibition at the American Museum of Natural History by the Department of Invertebrate Zoölogy. This animal is known to occur to a depth of over 2,000 feet in the seas off the coast of Japan. The largest specimen in any collection is said to be that in the British Museum. It has a spread of 18 feet. Even larger specimens are, however, occasionally captured. One is recorded to have had a spread of 22 feet. The specimen in the American Museum is from Miura-Misaki, and was secured by Professor Bashford Dean, of Columbia University.

PEARY TO TRY AGAIN

MORRIS K. JESUP, president of the Peary Arctic Club, sends the Magazine the following statement:

The Peary Arctic Club, at its recent meeting resolved unanimously to place the *Roosevelt* on the docks for a complete outfit, and to thereafter tender the same to Commander Robert E. Peary for another attempt to be made by him to reach the North Pole. The club has taken this action upon reports furnished by Commander Peary, and believes that he will be successful. They have entire confidence in this gallant and intrepid American, and share in the pride which must animate the American people to see this effort, which the club believes will be the final one and the planting on the North Pole the American flag.

The steamer *Roosevelt* has not been structurally injured by the last voyage, and when repaired will be equally, and perhaps even more, able than when she started north in 1905.

The Peary Arctic Club asks the aid of those who have heretofore contributed, as well as the coöperation and aid of all or any who feel an interest in this patriotic enterprise. The expense of the expedition, it is estimated, will be one hundred thousand dollars, and it is hoped this amount will be contributed by the many, and not the few, as heretofore.

Subscriptions may be sent to President Henry Parish, New York Life and Trust Company, No. 52 Wall street, treasurer.

MORRIS K. JESUP,
President.

At a meeting of the Board of Managers of the National Geographic Society on March 7, President Willis L. Moore in the chair and the following members present, Messrs Charles J. Bell, Alexander Graham Bell, F. V. Coville, Charles Denby, A. J. Henry, C. Hart Merriam, General John M. Wilson, Gilbert H. Grosvenor, and F. B. Eichelberger, the following resolution, proposed by Dr Alexander Graham Bell and seconded by General John M. Wilson, was unanimously adopted:

Resolved, That $1,000 from the Research Fund of the National Geographic Society be subscribed to the Peary Polar Expedition of 1907-1908.

In forwarding the amount President Willis L. Moore stated that the National Geographic Society wished to show its appreciation of the important scientific and geographical work performed by Mr Peary during the past twenty years in the Arctic regions, and its hope that he may complete his exploratoins to the north of Greenland and Grantland by the conquest of the Pole.

INTERNATIONAL FLAT GLOBE AND GEOGRAPHICAL HISTORY*

THE inventor of this flat globe has conferred a great service on the student or man of affairs who is interested in the geography of current events and wishes a convenient means of locating on the map points of interest. The flat globe is inexpensive and yet combines practically all the advantages of the old-fashioned globe. To get a true picture of the geographical relationship of the countries of the world, a globe is superior to a map, for it gives a comprehensive and not a fragmentary setting. In the flat globe the western hemisphere is printed on a disk 28 inches in diameter, and the eastern hemisphere on the reverse side. The disk is a heavy, flexible cardboard, which is hung against the wall, and can be easily turned over. Accompanying the globe is a volume of 100 pages, edited by Commander Robert E. Peary, U. S. N., one-half being devoted to physical and mathematical geography, and the second half to a summary of the most important and latest facts concerning the various countries of the world. Numerous illustrations and relief maps accompany the text. For instance, if a person wants some definite information about Rumania, the scene of recent disturbances, he locates the country on the globe and then turns to that subject in the Geo-

* Published by the International Globe Co. of New York.

graphical History, which we quote below.

* "RUMANIA.—A limited monarchy of eastern Europe. Area, 51,098 square miles; population, 5,912,520. Between 43° to 48° north latitude and 23° to 30° east longitude. Capital, Bucharest; population, 283,145; Jassy, 78,611; Galatz, 63,987. Most of the country is a well-watered plain, with skirts of the Carpathians only in the west and north. The Danube is the chief river, navigable throughout, but of its tributaries only the Pruth is navigable for steamers and the Sereth for rafts. The climate is continental because the country is open to the northeast. Seventy-five per cent of the people are farmers, but primitive methods still prevail. The soil is very fertile, and all products of the temperate zone, and even rice, are raised. The chief crops are maize (the staple food), wheat, barley, oats, rye, tobacco, and wine, all produced in excess of the demand. More maize is raised than in any other country of Europe. Domestic animals are raised in large numbers. The mineral wealth is great, but only petroleum and salt are worked extensively. Petroleum byproducts are used for fuel on railroads, steamboats, and in factories. Manufactures are primitive and all the finer products must be imported. Flour mills, distilleries, and tobacco works are the chief industries. Foreign capitalists own all important manufacturing enterprises, so that the Rumanians derive little profit from them. Races: Rumanians, 400,000 Jews, 200,000 Gypsies, 85,000 Slavs, 40,000 Germans, 30,000 Hungarians, 8,000 Armenians. Religions: Greek Orthodox, Roman Catholic, Protestant, Israelite, and Mohammedan. Grain is three-fourths of the exports and imports are mainly textiles and iron goods. Foreign trade (1902): Imports, $54,686,000; exports, $72,340,000."

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The NATIONAL GEOGRAPHIC MAGAZINE

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE ROCK CITY OF PETRA*

By Franklin E. Hoskins, D. D., of Beirut, Syria

The first of a series of several articles describing rock-hewn edifices of antiquity

THE highlands east of the Jordan River are strewn with ruins marking the rise and fall of successive civilizations—Semitic, Greek, Roman, Christian, Mohammedan, and Crusader. These ruins have been preserved for the modern explorer by the tides of nomadic life, which have swept up from the Arabian desert; but at the southern end of this no-man's land, deep in the mountains of Edom, lies one of the strangest, most beautiful, and most enchanting spots upon this earth—the Rock City of Petra. Its story carries us back to the dawn of human history. When Esau parted in anger from Jacob he went into Edom, then called Mount Seir, and after dispossessing the Horites became the progenitor of the Edomites, who remained the enemies of the children of Israel for a thousand years. These Edomites had princes, or kings, ruling in the Rock City while the children of Israel were still in Egyptian bondage. Some of the darkest maledictions of the Old Testament prophets are those aimed at Edom.

A GREAT "SAFE DEPOSIT"

In the days of the Nabatheans, Petra became the central point to which the caravans from the interior of Arabia, Persia, and India came laden with all the precious commodities of the East, and from which these commodities were distributed through Egypt, Palestine, Syria, and all the countries bordering on the Mediterranean, for even Tyre and Sidon derived many of their precious wares and dyes from Petra. It was at that time the Suez of this part of the world, the place where the East and the West met to trade and barter. It was also in fact a great "safe deposit" into which the great caravans poured after the vicissitudes and dangers of the desert. Its wealth became fabulous, and it is not without some good reason that the first rock structure one sees in Petra, guarding the mysterious entrance, is still called "Pharaoh's Treasury." It must have been the Nabatheans who developed the natural beauties of the situation and increased the rock-cut dwellings and temples and tombs to the almost interminable extent in which they are found today.

The palmy period of the Nabatheans extended from 150 B. C. to 106 A. D., when the Romans conquered the country and city, extended two Roman roads into it, and established the province of Arabia Petra. The Rock City was always to

*An address to the National Geographic Society, December 21, 1906.

these regions and peoples what Rome was to the Romans and Jerusalem to the Jews. Horites, Edomites, Nabatheans, and Romans have all rejoiced and boasted in the possession of this unique stronghold and most remarkable city of antiquity.

When Rome's power waned and the fortified camps on the edge of the desert were abandoned, no doubt the soldiers were withdrawn from such cities as Petra. Then the Romanized Nabatheans or Nabatheanized Romans held their own against the desert hordes as long as they could, and went down probably about the same time as the Greek cities of the Decapolis (636 A. D.). From the time onward Petra's history becomes more and more obscure, and for more than a thousand years Edom's ancient capital was completely lost to the civilized world. Until its discovery by Burckhardt, in 1812, its site seems to have been unknown except to the wandering Bedouin.

THE SIK OR ENTRANCE DEFILE

The entrance to the Rock City is the most striking gateway to any city on our planet. It is a narrow rift or defile, bisecting a mountain of many-hued sandstone, winding through the rock as though it was the most plastic of clay. This sik, or defile, is nearly two miles long. Its general contour is a wide semicircular swing from the right to the left, with innumerable short bends, having sharp curves and corners in its general course.

The width of the Sik varies from twelve feet at its narrowest point to 35 or 40 feet at other places. Where the gloomy walls actually overhang the roadway and almost shut out the blue ribbon of sky, it seems narrower, and perhaps at many points above the stream the walls do come closer than 12 feet. Photographs of these narrower and darker portions of the defile are impossible. Only where the walls recede and one side catches the sunlight (see photo., p. 285) was it possible to secure any views that would reveal the actual beauties of the place. Then no camera could be arranged to take in the whole height of the canyon. The height of the perpendicular side cliffs have been estimated at from 200 to 1,000 feet. Heights, like distances, in this clear desert air are deceptive, but after many tests and observations we are prepared to say that at places they are almost sheer for 300 to 400 feet.

Seen at morning, at midday, or at midnight, the Sik, this matchless entrance to a hidden city, is unquestionably one of the great glories of ancient Petra. Along its cool, gloomy gorge file the caravans of antiquity—from Damascus and the East, from the desert, from Egypt and the heart of Africa. Kings, queens, and conquerors have all marveled at its beauties and its strangeness. Wealth untold went in and out of it for centuries, and now for over thirteen hundred years it has been silent and deserted.

PHARAOH'S TREASURY

The first time we picked our way into this matchless defile we wandered on amazed, enchanted, and delighted, not wishing for, not expecting, that anything could be finer than this, when a look ahead warned us that we were approaching some monument worth attention, and suddenly we stepped out of the narrow gorge into the sunlight again. There in front of us, carved in the face of the cliff, half revealed, half concealed in the growing shadows, was one of the largest, most perfect, and most beautiful monuments of antiquity—Pharaoh's Treasury (see photo, p. 286). Almost as perfect as the day it came from beneath the sculptor's chisel, fifteen hundred or two thousand years ago; colored with the natural hues of the brilliant sandstone, which added an indescribable element to the architectural beauty; flanked and surmounted by the cliffs, which had been carved and tinted in turn by the powers of nature; approached by the mysterious defile—it is almost overpowering in its effect.

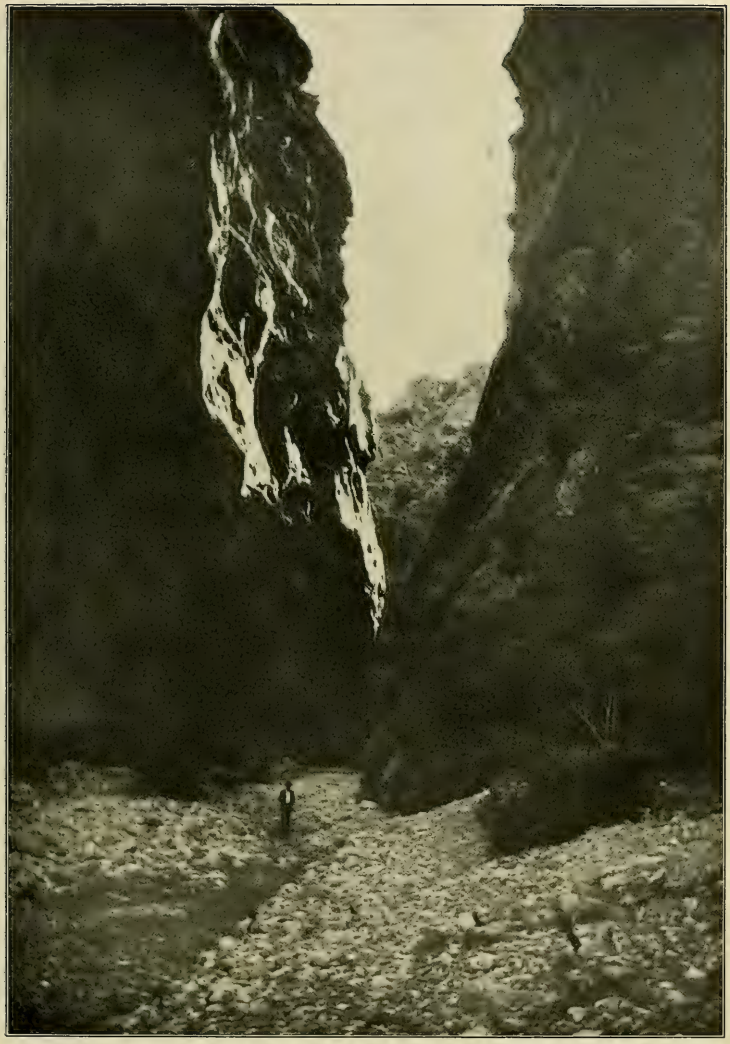


Photo by Libbey and Hoskins

Gorge of the Sik or Entrance to Petra

Where the rift widens out and makes a sharp bend to the left. Every person and everything entering the city—which numbered several hundred thousand inhabitants—was obliged to pass through this defile, which is nearly 2 miles long. Afterward, when the Romans came, they built two military roads over the mountains down to the city

Pharaoh's Treasury, Petra Photo by Libbey and Hoskins

The finest picture ever taken of this matchless monument of antiquity

Descriptions of the width and height and the details of this monument of antiquity may enable many to reproduce for themselves some of its striking features; but neither language, measurements, nor pictures can give more than a bald idea of the temple and its charming surroundings. The secret of its magic seems to be the culmination of man's best efforts with the powers and beauties of nature.

Located at the end of a long and difficult journey, whether one comes from the valley of the Euphrates, from Sinai, from Egypt, or from any point of Syria east or west of the Jordan; set in the mountains of mystery, at the gateway of the most original form of entrance to any city on our planet; carved with matchless skill, after the conception of some master mind; gathering the beauties of the stream, the peerless hues of the sandstone, the towering cliffs, the impassable ravine, the brilliant atmosphere, and the fragment of blue sky above—it must have been enduring in its effect upon the human mind. We saw it in its desolation, a thousand years after its owners had fled—tempest, flood, and earthquake having done their worst, aided by the puny hand of the wandering Arab, to mar and disfigure it—and we confess that its impression upon our hearts and memory is deathless.

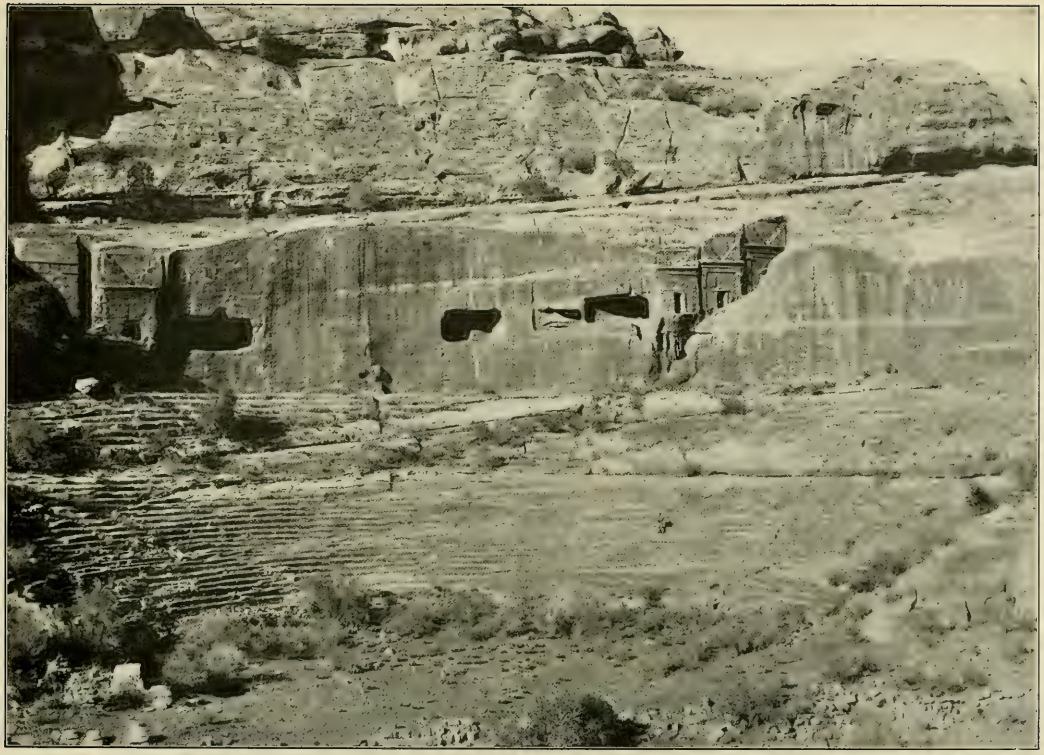
To portray the marvelous coloring of these masses of sandstone and to give anything like a correct view of this unique feature of Petra is something we attempt with misgivings. From the moment we sighted the great castellated mass in which the city lies hidden until we took our last glimpse from the highlands above, we never ceased to wonder at the indescribable beauties of the purples, the yellows, the crimsons, and the many-hued combinations. Whether seen in the gloom of the Sik, or the brilliant sunshine, that seemed to kindle the craggy, bristling pinnacles into colored flames, they continued to inspire our surprise.

Travelers have vied with each other in their attempts to describe these beauties. After the solid colors of red, purple, blue, black, white, and yellow, the never-ending combinations are best compared with watered silk or the plumage of certain birds.

We shall be listened to if we say with all soberness that "the half was never told" of the effect of this many-hued landscape; for as we saw it glistening with the rain drops after the showers, we saw it before the sunrise, we saw it under the noonday sun, and we noticed, as perhaps no one had done before us, the way in which these ancient sculptors fixed the levels of their tombs and temples and dwellings so as to make most artistic use of the more beautiful strata in the mountain walls, and we marveled again and again, in the never-ending ravines, how these ancient dwellers consciously practiced a kind of landscape gardening, where, instead of beautiful effects produced by banks of fading flowers, all was carved from the many-hued and easily wrought solid stone, which took on new beauties as it crumbled away.

THE GREAT THEATER

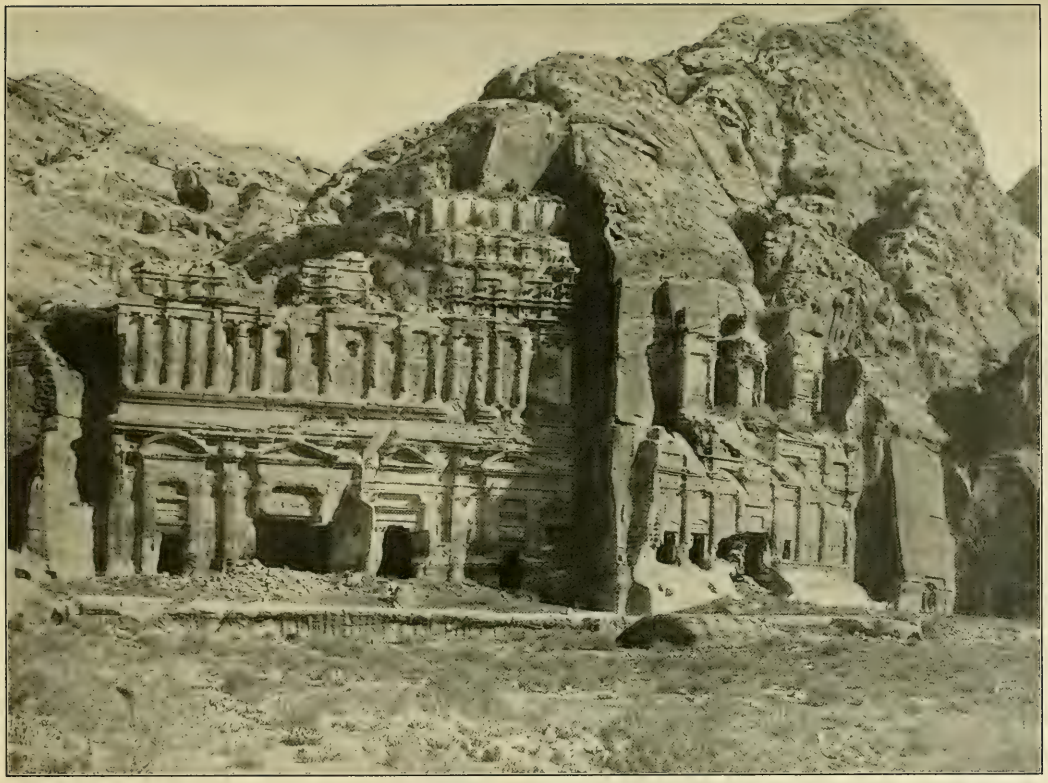
Not far from Pharaoh's Treasury is a great theater (see page 288) cut in what may be called the Appian Way of the city. It stands among some of the finest tombs—a theater in the midst of sepulchers. The floor of the stage is 120 feet in diameter. Fully 5,000 spectators could have found comfort in the thirty-three rows of seats. Here also the coloring of the sandstone is brilliant, and at certain places in the excavation the tiers of seats are literally red and purple alternately in the native rock. Shut in on nearly every side, these many-colored seats filled with throngs of brilliantly dressed revelers, the rocks around and above crowded with the less fortunate denizens of the region, what a spectacle in this valley it must have been! What an effect it must have produced upon the weary traveler toiling in from the



Rock-hewn Theater at Petra

Photo by Libbey and Hoskins

Seating 5,000, where seats are rainbow hued, 300 feet in diameter, and 130 feet from floor to top of cutting. Note the figure of a man standing in amphitheater



Corinthian Tomb and Temple

Photo by Libbey and Hoskins

The finest location in the city and most beautifully colored. Carved out of solid rock, no placed stones or cement or mortar being used

The Dier, or Monastery, Petra

Photo by Libbey and Hoskins

Notice the figures in the doorway, which is 30 feet high, and the single figure on the cupola, 100 feet above

burning sands of the desert, along the shadows of the marvelous Sik, past the vision of the Treasury, and into the widening gorge that resounded with the shouts of the revelers, in the days of its ancient glory.

The eastern wall of the valley, near the entrance, rises to a height of more than five hundred feet. For a length of a thousand feet the face of the cliff is carved and honeycombed with excavations to a height of three hundred feet above the floor of the valley.

Here are found some of the most impressive ruins in the city. The Urn tomb in the center has in the rock behind it a room over 60 feet square, whose beautifully colored ceiling can be compared to a great storm in the heavens. The Corinthian tomb and temple (see p. 289) are among the largest and most beautifully colored monuments in any of the walls.

The Deir is reached by one of the great ravines up which winds a path and stairway until an elevation of 700 feet is attained. A small plateau opening toward the south gives an extended view of Mount Hor and all the southern end of the Dead Sea cavity. The spot is wholly inaccessible except by the one rocky stairway and winding path.

The Deir is carved from the side of a mountain top, but not protected by any overhanging mass. It is larger than the Treasury, but not nearly so fine in coloring or design. It is impressive in its size and its surroundings, but cannot be called beautiful.

Finally, if you will remember that originally the whole valley, from its beginning at the door of the Sik until its exit among the fissures at the southern end of the Dead Sea, is one huge excavation made by the powers of nature, the torrent and the earthquake; and that the hand of time, the frost, the heat, and the tempest have been busy through the ages cracking, smoothing, chiseling mountain top, deep ravine, and towering cliff into a myriad of fantastic forms, and that the subtler, silent agencies of Nature's alchemy have been added the most brilliant hues to moldering sandstone strata, you cannot but be charmed and amazed at the result of her handiwork.

Then when you enter the city by the winding valley of the Sik, gaze at the stupendous walls of rock which close the valley and encircle this ancient habitation, and mark how man himself, but an imitator of Nature, has adorned the winding bases of these encircling walls with all the beauty of architecture and art—with temple, tomb and palace, column, portico and pediment—while the mountain summits present Nature in her wildest and most savage forms, the enchantment will be complete, and among the ineffaceable impressions of your soul will be the memories of this silent, beautiful "rose-red city half as old as time."*

* For further information on this remarkable city the reader is referred to *The Jordan Valley and Petra.* By William Libbey, Sc. D., and Franklin E. Hoskins, D.D. Two volumes. Vol. I, XV and 353 pp. and 74 illustrations. Vol. II, VIII and 380 pp. and 85 illustrations, 7 appendices, index, and map. G. P. Putnam's Sons, New York, 1905.

RECLAIMING THE SWAMP LANDS OF THE UNITED STATES*

By Herbert M. Wilson, U. S. Geological Survey

THE available agricultural lands of the United States have nearly all passed into private ownership, and the larger portion is under cultivation. With rapidly growing population and greater demand for agricultural products, the need of additional farm land grows apace. Similar influences resulted a few years ago in the creation of the Reclamation Service for developing the water supply available for irrigating the arid lands. It is believed that the maximum area which has been brought under cultivation by irrigation approximates 8,000,000 acres, and it is estimated that there has been brought into agricultural use by drainage areas equal to if not in excess of those so developed by irrigation. Further, while the area estimated by the Reclamation Service as possible of reclamation by irrigation within the next quarter century may not exceed 12,000,000 acres, it appears equally probable that the areas of existing swamp lands of the United States which may be made available for agricultural uses by drainage exceed those which may be reclaimed by irrigation, providing the drainage works were undertaken by the Federal Government with vigor equal to that devoted to irrigation reclamation.

As agricultural lands are becoming more scarce and the people of the country have seen what the government can do in bringing water to the barren deserts of the West, they realize that the same government might be equally successful in removing a superabundance of water. They are beginning to appreciate as never before the patent fact that waste swamp lands may be rendered not only habitable, but more productive than less fertile neighboring lands naturally drained. Now that the federal government is expending millions of dollars annually for the reclamation of the desert lands of the arid West through the agency of irrigation, those of us who live in more humid regions are beginning to regard the vast swamps of the Missouri and Mississippi valleys and their tributaries, and those of Florida and the Atlantic coast, and of the Sacramento Valley of California as the only large areas of possible agricultural lands remaining undeveloped.

MANY SWAMPS IN THE UNITED STATES CAN BE RECLAIMED

In the United States are over 60,000,000 acres of swamp or overflowed lands. Let us speculate on what drainage of one-half of this may mean. If it were possible to reclaim by drainage 25,000,000 acres of these swamps, the land values of the country would be increased by more than $2,500,000,000 and the crop values of these sections by more than $750,000,000. If it is possible to subdivide this enormous area into forty-acre farms, it will supply 1,250,000 families with homes, and it would put 6,000,000 people upon lands that are now practically worthless. It is safe to say that each of these families will spend $2,000 in houses and in equipments for their farms. This will cause the expenditure on the waste land of today of more than $2,500,000,000. An average family of five will spend $600 per year. This will mean to the business interests of the United States an increased trade of $750,000,000.

The Senate Committee on Public Lands of the 59th Congress reported favorably a federal drainage bill which, if enacted into law, will eventually produce results not differing far from the above, which now appear but an enthusiast's dream.

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When the Reclamation Service came into existence, in 1902, it found ready-made a vast amount of essential preliminary information in the topographic maps of the United States Geological Survey. A study of these maps showed at once possible opportunities for creation of reservoirs for water storage and the relation of these and of perennial water supplies to irrigate lands. The engineers were thus enabled within a few months to segregate a number of important projects and put into the field large forces upon the preparation of the detailed plans for construction. To the existence of these topographic maps is to be credited much of the glory of the prompt achievement of the Reclamation Service. Now, five years later, there is available an even larger amount of the topographic mapping so essential as preliminary information to the detailed study of drainage projects. Upon the existence of this data and its intelligent use will depend much of the success of such swamp reclamation as may be undertaken for the whole country on broad and economic lines.

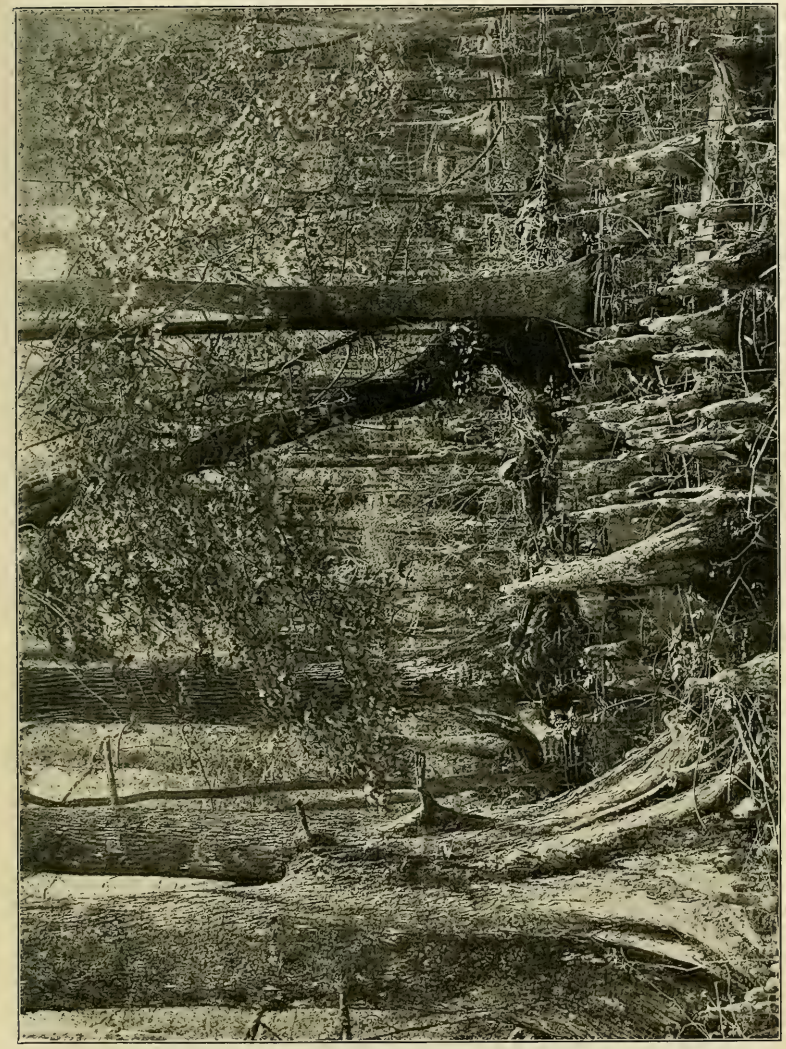
ONE-THIRD OF THE UNITED STATES HAS BEEN MAPPED IN GREAT DETAIL

Topographic mapping has been completed in either preliminary or final form for nearly one million square miles, or almost one-third of the area of the United States. All of the mapping of recent years has been executed in great detail, in the course of which many thousands of miles of spirit levels have been run, from which permanent marks have been left, and the resulting data furnishes a vast amount of important engineering information concerning the slopes and the drainage of the surface of the land. These maps show where the swamps occur and their relation, both in distance and position, to natural drainage channels. Far more important than this, however, their inspection shows, on close scrutiny, all the facts of importance relative to the altitude of the swamps as referred to the surrounding hills and the drainage channels. It is evident, therefore, that a study of these maps shows where the swamps of the country lie, their extent, and furnishes in a preliminary way essential information as to the possibility of draining them. These maps do not furnish the engineering data needed in the location of an artificial drainage system nor in the making of estimates for construction, but they leave to the engineer only the necessary field inspection and more detailed location and construction surveys essential before definite plans and estimates can be prepared. Had such maps been in existence in the earlier days of discussion of such drainage projects as the Kankakee marshes of northern Indiana and of the tule lands of the Sacramento Valley, many hundreds of thousands of dollars wastefully expended in ill-digested drainage schemes might have been saved and useful works constructed where nothing has yet been accomplished.

The most important feature of any great engineering study covering a widely extended territory, is the preliminary examination which furnishes all the data essential to a complete understanding of every possible means of accomplishing the end sought. Hundreds of thousands of dollars have been squandered in railway locations because the engineers, working in unknown territory, have adopted the first feasible route, whereas, had they possessed detailed maps of the entire territory, better alignment and better grades might frequently have been secured. So it is with any large drainage project, and years may be spent in developing difficult projects for drainage through routes which appear the only practicable ones available, whereas a complete knowledge presented in bird's-eye view, as on a topographic map showing the relations of the swamp lands to all of the surrounding drainage channels, may frequently develop opportunities previously unsuspected.

A few years ago it was the fashion for orators expounding upon the advantages of irrigation to point to its great antiq-

A Road in the Dismal Swamp, North Carolina, showing the Shallowness of the Water



Cypress Swamps in the Dismal Swamp, North Carolina, showing the Shallowness of the Water

uity, and to show how even in biblical times the valleys of the Euphrates and of the Nile and the Jordan were watered artificially, even before the Hindoos and Mexicans developed their irrigation systems; but we may point to almost equal antiquity for drainage. Biblical references to this may be lacking only because the people of biblical times lived in arid regions, but in Greece, at an early period, record is left of the reclamation of swamp lands by drainage. The earliest drainage project of any magnitude is that for the reclamation of Lake Copias, a great marshy tract in the neighborhood of Thebes, Greece, 60,000 acres in extent. In modern times this project has been elaborated, and twenty miles of main canal, a wide dike, and 2,000 feet of tunnel have been constructed. This work is of special interest to us because at the outfall of the drainage channel is a drop of 170 feet which will yield about 1,000 horse-power, and, still more interesting, this water will then be available for irrigation of the arid land near the city of Anthedon.

THE DRAINAGE OF THE VALLEY OF MEXICO

On our own continent the project for the drainage of the valley of Mexico dates back to the fourteenth century, when the Aztec kings built their city on an island among the lakes and protected it by dikes of great magnitude. They divided the area which they drained into five districts, in such manner that the swamps have been segregated about five lakes. It was they who started the celebrated Nochistongo cut for the discharge of the river Catutlitan. In the seventeenth century this project was replaced by one for tunneling, when a force of 15,000 Indians completed a tunnel ten miles in length in the almost incredible time of eleven months. Owing to faulty construction, this tunnel caved, and it was over one hundred years afterward before the present drainage projects, which include the whole valley of Mexico, were undertaken. These drainage works had cost the Mexican treasury $3,000,000 by the middle of the seventeenth century; over $8,000,000 by 1830; and now, as they are nearly completed, a total of $20,000,000 has been expended on them. The results have, however, been fully commensurate to the outlay. A vast area has been drained, freed from malarial diseases, and made not only habitable, but productive in the highest degree. The main canal controls the entire drainage system of the valley; is thirty miles in length, with an extreme depth of 60 feet and a bottom width of 17 feet. These works, which include a great tunnel 12 feet in diameter, rank with the greatest achievements of modern times.

BEGINNING IN THIS COUNTRY

In our own country many drainage works of minor importance have been undertaken by individuals, corporations, districts and states. In Louisiana much important work has been done in the neighborhood of New Orleans; in Florida near the Everglades; in Minnesota and North Dakota on the upper Red River valley; in Indiana, in the Kankakee marshes, and in California in the lower Sacramento Valley. The existing works in our own country, however, bear about the same relation to those still untouched as did the earlier irrigation works of the West to the vast undertakings now under construction by the Reclamation Service. All projects which were most evident and which on examination presented the best prospects of financial success have been constructed. The people of Illinois, of lower Minnesota and other portions of this vast country have built ditches and drained the lands in which they now live; but the more extensive and more expensive drainage projects await that touch of the wizard's wand which, held by the federal government, alone may derive sufficient benefit in the creation of new homes and new productive areas to warrant the vast expenditure and the tardy return which their reclamation promises.

As with irrigation, this problem was first turned over for solution to the states, to which the government patented over

63,000,000 acres reported by the General Land Office as swamp lands. In so doing the original legislation contemplated the early reclaiming of these lands by the construction of ditches or levees. The states have parted with much of these swamp lands in grants to railroads, to corporations, and to individuals in the expectation that they would drain them. The complications, however, resulting from any attempt on the part of private institutions, or of counties or states, arising from conflicting property rights and conflicting benefits, have proven such that many of the most important projects remain yet unstudied. If an individual build the works, how will he be recompensed for benefits to adjoining works of his neighborhood? If the state build the works, how will it be recompensed for benefits to government lands? If the federal government build the works, it alone may successfully secure the cooperation of individual landholders and of states, and assess benefits proportionately among all. The way has been blazed for us by the Reclamation Act. The procedure in organization of the landholders into associations has been so successfully worked out that the government is actually constructing great irrigation projects at vast expenditure of federal funds when the immediate benefit will accrue almost wholly to private landowners, who shall recompense the government for the outlay.

For a number of years several of the states have been actively engaged in efforts to aid their people in the drainage of their swamps. Foremost among these in results accomplished are the states of Minnesota, California, and Florida. In the former is a state drainage commission provided with generous annual appropriations, which are expended through the medium of a drainage engineer in actual construction of ditches. A reconnaissance survey for the study of drainage projects has been made for nearly the whole upper portion of Minnesota, and many miles of more detailed surveys have been made throughout the length of the Red River valley in Minnesota and North Dakota, covering projects for construction of many drainage ditches. Finally, a number of these ditches, some of considerable capacity, have been built and are reclaiming lands through which the farmers have constructed their separate farm drains.

RECLAIMING THE SWAMPS IN SACRAMENTO AND SAN JOAQUIN VALLEYS, CALIFORNIA

In California the state has been engaged for many years in studying projects for and aiding in the reclamation of overflowed and swamp land in the lower Sacramento and San Joaquin valleys. These lands are so low lying that gravity drainage by ditches has been found impracticable and reclamation is by the construction of levees and the pumping of the enclosed area. Some of the protective works in that state are of great extent, covering from seventeen to sixty thousand acres each and involving expenditures ranging from $150,000 to $1,250,000 in various districts. At present there is under consideration a systematic scheme for leveeing, drainage, and pumping, the construction of which will cost many millions of dollars. Individual, county, district, and other independent efforts have resulted in the expenditure of over seventeen million dollars for construction purposes in this area which have been actually wasted, as the work of reclaiming will have to be done over on broader and more comprehensive lines, so that the drainage for these vast areas of submerged land may ultimately involve expenditures exceeding twenty-five millions of dollars.

THE CONDITIONS IN FLORIDA

In Florida the drainage problem has been an acute one for several years past. Realizing how sparsely Florida was settled and how difficult it would be to induce railroads to build through its wildernesses, the United States government in 1856 granted to the state every alternate section in a strip 12 miles wide as an in-

Outline Map showing Swamp Areas in United States

The black indicates swamp areas; ruled portion indicates areas interspersed with swamps

ducement to railroad building. This and an earlier grant of 500,000 acres in 1841 are in no wise connected with the Swamp and Overflow Act of 1850. This latter act, with succeeding acts of like kind, ceded to the state of Florida and to other states the bulk of the swamp lands with a view to the states constructing the necessary levees and drains to reclaim the swamp and overflowed lands within their borders. Among other things, the act provided that the fee-simple title to said lands should vest in the said states "subject to the disposal of the legislatures thereof; provided, however, that the proceeds of the said lands—whether from sale or by direct appropriation in kind—shall be applied exclusively, as far as necessary, to the purpose of reclaiming the said lands," etc. Under this act Florida received about 20,000,000 acres of land, "the proceeds of which," the act itself says, "shall be used exclusively for their own drainage."

But the legislatures of the early eighties were railroad legislatures—they believed in building railroads and opening up the state to immigration; and any company which would agree to build a good road could secure a land grant of from 5,000 to 20,000 acres for every mile built, and if the state owned no land contiguous to the line building, it would be given land perhaps several hundred miles distant.

Governor Jennings, in 1901, took the position that the United States government has granted these lands to the state for their reclamation and drainage, and that the law had not intended that these lands should be given railroads which had not built perhaps within two hundred miles of them. His successor, Governor Broward, introduced a bill, which was passed with only four votes recorded against it in both houses, and in order to make the act secure a joint resolution for an amendment to the constitution of the state embodying this act was also passed.

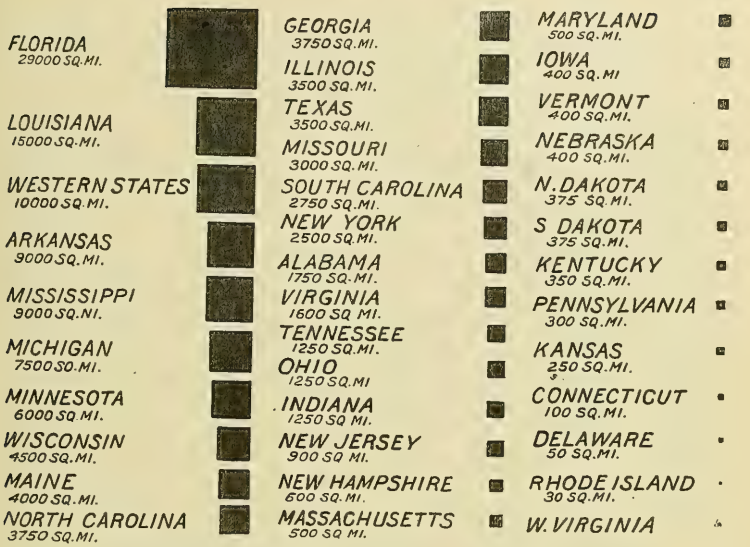


Diagram Illustrating the Swamp Areas of the Different States

This act provides for "drainage districts," in which they may levy a tax, not to exceed ten cents per acre per annum, on all swamp or overflowed land in that district, and to expend the money so collected in the drainage of these lands.

Progressing now, as with irrigation, from state to federal action, the United States government has recently shown a disposition to aid in the reclaiming of swamp lands by drainage. The period of unaided private endeavor is long past; the effort at state reclamation through drainage districts is showing its inability to cope with the problems involved. None can doubt that ultimately the federal government must take up the problem and treat it in the broad and comprehensive manner essential to its proper solution. A few years ago the Division of Irrigation Investigations of the Bureau of Experiment Stations of the Department of Agriculture had its title changed to that of Irrigation and Drainage Investigations, with an increased appropriation, the purpose of which was to cover drainage inquiries. For several years past this division has examined into and prepared plans for the drainage of individual farms as examples for the neighborhood, and also of large areas of swamp or overflowed land, of which it has made surveys through the various agricultural experiment stations, sometimes in cooperation with the states. An instance of the latter work has been a complete preliminary survey of the western side of the Red River valley in North Dakota. From this, preliminary plans and estimates have been prepared having in view the complete reclamation of the swamps involved. Similar investigations have been made by this division on the Missouri River near Yankton, South Dakota, the Wabash River in Indiana, the Illinois River in Illinois, in the Florida

Everglades, and elsewhere. The above work has had in view only the furnishing of assistance to individuals or to communities and does not contemplate federal construction, nor have permanent marks been left on the ground by the surveys.

Recently, at a first national drainage congress, held in Oklahoma, a national drainage association was organized, the purpose of which, through annual meetings and other organized effort, is to advance the cause of federal reclamation by drainage. The congress authorized the appointment of a vice-president from each state, in addition to the president, secretary, and other executive officers. Resolutions were passed recommending that the federal Congress enact legislation which would provide for survey and actual construction by the federal government of drainage reclamation works. During the last two sessions of Congress several bills have been introduced having this end in view. Some of these are of local application; one provides for the drainage of the Dismal Swamp of Virginia; another provides for the drainage of the swamp lands of Minnesota, but by far the more important are several bills "for the establishment of a drainage fund and the construction of works for the reclamation of swamp and overflowed lands" in all the states. These bills are drawn on lines following closely the Irrigation Reclamation Act of 1902. They provide for the creation of a special drainage fund in the Treasury Department, to be derived from moneys received from the sale and disposal of public lands in the states east of the arid region; also for a working fund of about $2,000,000, to be loaned by the federal government until such time as the sale of reclaimed lands may permit of its return to the Treasury. The drainage fund is made a revolving fund by arranging that the cost of construction of drainage work shall be assessed against the land sold and the proceeds returned to the fund. It is finally provided that the execution of the act shall be vested in the Secretary of the Interior, presumably in the existing Reclamation Service, which has already proved its efficiency.

PRELIMINARY PLANS

A special act passed by Congress in its session of 1905-'6 appropriated $15,000 for a survey and report with a view to construction of drainage works for the reclamation of the swamp lands in the ceded Chippewa Indian reservations in Minnesota. Under this act surveys were made in the fall of 1906 by the Geological Survey covering over 400,000 acres of these lands. The segregation and withdrawal from sale and occupation of unsold government lands in this area reserves the remaining public lands as a source of revenue from which to refund the cost of construction. The report of the results of this survey shows that the necessary works involve the drainage of nearly 267,000 acres of land and the improvement of 135,000 additional acres. In the short period of three months sufficient instrumental data was secured to make it evident that here was an admirable and typical drainage project showing what may be done under federal direction. Main lines of canal, with subsidiary and minor drainage ditches to reach every 160 acres were designed, and the estimated cost of construction of these works is about $1,080,000. Dividing the reclaimed lands into groups according as they will be wholly reclaimed or only improved, it is found that an average assessment of from $1.62 to $3.23 per acre will cover the cost of construction. This is a region in which drained lands are at a premium at prices ranging from $12 to $15 per acre; so that it is evident that if these lands were drained the proceeds of their sale would readily return to the government the entire cost of construction, even if sold at a figure less than one-half that of current market values.

THE FLORIDA EVERGLADES

The reclamation of the Florida Everglades is more than a promoter's dream;

some important drainage work has been done already through grants from the state, especially to the Disston Company, on the Kissimmee lands, whose Saint Cloud plantation yielded over 6,000 pounds of dry sugar to the acre for an entire month's run. These lands are in the upper portion of the celebrated Everglades which surround Lake Okeechobee, in the central part of the state, and from there stretch due south one hundred miles to Cape Sable, varying from twenty to forty miles in width and covering an area of 3,700,000 acres.

There are stretches of prairie land in this, and there is considerable cypress timber, but the most of it is a saw-grass marsh with a soil from three to fifteen feet in depth, covered with a few inches of water the greater part of the year. During an exceedingly dry season water can only be found in the sloughs or runs, which extend in every direction. During and after the rainy season, which usually extends from June to September, when the Kissimmee Valley has poured all of its rainfall into Lake Okeechobee and filled up the "glades," it is quite easy to get about through the tortuous channels—provided you use a small skiff.

Along the eastern edge of the Everglades there is a ledge of rotton limestone, slightly higher than the surface of the glades, which in a measure holds back the water from overflowing the adjacent lowlands. In order to drain the Everglades it would be necessary to widen and deepen the rivers where they have cut through the rock reef, and then extend them by a system of canals until Lake Okeechobee was reached. After cutting through this rock reef nearly all the excavation necessary would be through sand and muck.

THE DISMAL SWAMP

The celebrated Dismal Swamp of Virginia is one of the well-known swamp areas awaiting reclamation. This is an ordinarily elevated, nearly level land, with such imperfect drainage that it remains constantly inundated to a slight depth. The swamp is practically on a hillside, sloping gradually upward from an altitude of twelve to twenty-two feet above mean tide at its summit, near the center of which is Lake Drummond—a shallow, circular body of water about 2¾ miles in diameter and only five to six feet in depth. The lake is surrounded by woods, and at some points cypress trees grow into the water, the depth of which decreases rapidly through the swamp, where it is rarely greater than 1½ feet, and is usually but a few inches. Some of the marginal portions of the swamp have been drained and furnish excellent farming land. The original swamp at one time included the Green Sea, but the Dismal Swamp Canal has in measure drained the intervening region, in which work the branch Herring Canal has aided. This indicates what may possibly be accomplished by the further construction of drainage ditches.

Another of the great swamps of the United States is the Kankakee Marshes, which cover about one-half million acres distributed over seven counties in northern Indiana. The swampy condition of Kankakee Valley is due to a slight fall in the valley and the extremely crooked and tortuous channel of the river. Between its source and the Illinois State line the direct distance is 75 miles, whereas the stream flows a distance of 240 miles, in the course of which it makes at least two thousand bends. The difference in elevation between these two points is but 97 feet, or a fall of 1.2 feet per mile. It is not improbable that a complete topographic and drainage map covering the entire area, not only of the Kankakee Valley, but the neighboring uplands and drainage basins of the Wabash and the northern tributaries of Tippecanoe River, will develop drainage possibilities superior to those found within the Kankakee Valley alone.

THE REVOLUTION IN RUSSIA*

By William Eleroy Curtis

IN order to understand the significance of events in the revolution that is now going on in Russia, it is necessary to recall what you learned in your school days, that it has the largest area of any nation and a population of one hundred and forty million souls, including eighty million peasants. The illiterate classes constitute at least three-fourths of the population—one hundred and twelve millions who cannot read or write. During the last few years there has been a very rapid improvement in this respect by reason of the establishment of village schools, but a wise man once said that "a little learning is a dangerous thing," and his wisdom has been demonstrated in Russia.

The introduction of a school system accounts for the remarkable spread of socialistic ideas among the working classes of that Empire. Kipling once said that as long as a Russian muzhik wore his shirt outside his trousers he was a safe citizen; when he tucked it in, he became dangerous to the state. The truth of that quaint remark has been forcibly demonstrated within the last eighteen months. The Russian workmen, in the cities and factory towns and the peasants in the fields, who constitute four-fifths of the vast population, have vague and fantastic ideas of government and of the meaning of the word "liberty." They will follow anybody who promises to improve their condition, and are merciless and vindictive toward every one they distrust. For that reason they are more dangerous and destructive than the corresponding class in France.

THE PEASANT'S NEED OF LAND

The peasants were formerly serfs, and were emancipated by the grandfather of the present Czar, who is known as Alexander the Good. When they were given their freedom the government applied the socialistic principle that the soil belongs to the men who till it, and each family was given an average of six and a quarter acres of cultivated land, which was then sufficient to supply their wants. The increase of population has cut down this average to three and a half acres, which is not sufficient to support a family. According to experts, at least seven acres is necessary to sustain an average family; so that the peasant has only about half the land he needs. The remainder of the Empire is held in vast estates belonging to the government, the crown, the monasteries, the grand dukes, the nobility, and the boyars or gentry, and only part of it is under cultivation. The peasants need the idle land and they demand it. They have emphasized their demands with the torch and the bludgeon, and during the last eighteen months have destroyed several hundred million dollars' worth of property, including some of the finest estates in the Empire, under the leadership of demagogues, who have aroused their passions and have made them insane with drink. In his natural state the Russian peasant is honest, stupid, superstitious, and stubborn; when he is excited he becomes a savage. He has no ideals; he has no comprehension of politics; he does not comprehend the word "constitution," but he knows that he needs more land. There is not enough vodka in all the Empire to quench his thirst, and his vision is limited to his own local interests.

The greater part of the peasants' land is held in common and the fields are alloted by the village elders, who are elected by the heads of families and exercise a tyrannical authority over the communities. No peasant can sell his land or borrow money upon it; he cannot leave his native place without the consent of the elders. His condition of serfdom has been

*An address to the National Geographic Society, December 14, 1906.

continuous; only his master has been changed.

The provincial government is administered by "zemstovs," which enact and enforce laws for local purposes, assess and collect taxes, provide schools, build roads, look after the poor and the afflicted, and, under the censorship of a governor-general appointed by the Throne, perform the functions of our state officials.

THE CHAOTIC IMPERIAL GOVERNMENT

The imperial government is administered by the Czar with the assistance of a council of state corresponding to our Cabinet, and a Senate, which corresponds to our Supreme Court, with some additional jurisdiction. The Czar issues edicts which have the force of law, upon the recommendation of his ministers; the Senate formulates the imperial will into statutes and promulgates them. The Czar seldom sees his advisers together, but confers with them separately; so that there is no unity, no coöperation, no team-work, and continual friction, intrigue, misrepresentation, and misunderstanding.

The Prime Minister is nominally at the head of the government and is supposed to frame and direct its policy, leaving the details to his associates and subordinates, but in the past they have often tried to undermine and betray him and counteract his influence with the sovereign. Thus there is always a struggle going on around the Throne between conflicting interests in the cabinet, the members of the imperial household, and the Czar's own family, his mother and his wife taking an active part. His Majesty is pulled and hauled this way and that by the various factions that are able to reach him, and the person who has exercised the most powerful influence over him is his former tutor and the tutor of his father, an aged lawyer named Pobiedonostseff, for many years the actual head of the Russian church. He is the most reactionary man in Russia, a type of the fifteenth century statesman, the most conservative of conservatives, who resists all innovation as contrary to the well-being of man. He is convinced that the best form of government is an absolute despotism, and continually admonishes the Czar that he has no right to share the government with the representatives of the people, because God has conferred the duties and responsibilities of an autocrat upon him and he must retain them or offend God.

NICHOLAS II KIND AND VACILLATING

The Czarina was formerly very liberal, but since the birth of her boy, two years ago, her opinions have been reversed, and she is now quite as determined as the Czar's old tutor in support of the autocracy, because she desires to hand down to her son all the prerogatives and power his ancestors have exercised.

Nicholas II has a gentle disposition, a kind heart, and a desire to promote the welfare of his subjects. We have been told that a certain place is paved with tions and believes that progress is congood intentions; and he has an abundance of that material, but has no fixed purpose. He is a timid opportunist and usually acts too late. He vacillates as different people talk to him, and the last person he sees usually controls his actions. Instead of strengthening himself by attracting the support of the liberal elements, he has continually discredited his own sincerity and has placed himself in antagonism to the interests he promises to serve. He excites the distrust of his ministers and his supporters, instead of winning their confidence. Every concession he has made has been wrung from him by fear. He formally declared it to be his "inflexible will" that Russia should have a constitution and a parliament, but as soon as the words were uttered he began to devise means to prevent himself from carrying out his own promises or limiting their fulfillment as much as possible. Concessions that would have been received with universal gratitude at the beginning of the present year would now be rejected with contempt.

Naturally he is inclined to be liberal and tolerant. At the same time he is de-

votedly attached to the traditions of the autocracy, and has a profound sense of his obligations to the memory of his father and to the founders of the Romanoff dynasty, which makes him hesitate about departing from the policies they pursued. He has a deep vein of religious sentiment and is intensely superstitious. He believes in miracles and omens; he wears amulets. In order to secure an heir to the throne, he made a pilgrimage incognito to the shrine of Saint Seraphim, where women who have no children are accustomed to go. He surrounds himself with clairvoyants and often communicates with the spirit of his father through spiritualistic mediums. Charlatans impose upon his credulity and occupy time which should be given to matters of state. His ministers complain that he insists upon discussing trifles when momentous problems require his attention. He is devoted to his family; he is the first Czar that any one can remember who lived a moral life and his ministers complain that he is playing with his children when he should be in the council chamber.

He is a voluntary prisoner, guarded by an army of 6,000 men, and no one can see him except in the presence of his guards. He knows only as much about events and affairs as his attendants think expedient. They prepare a summary of the contents of the newspapers for him every morning and naturally do not include anything that might interfere with their own plans or weaken their own influence. He does not comprehend the situation in Russia. He has been the continual victim of misrepresentation and bad advice. If he would break away from the influences that surround him; if he would talk with well-informed and disinterested men, he might adopt a different policy.

THE OFFICIALS ARE NOT RESPONSIBLE TO THE PEOPLE OR THE COURTS

The fundamental error in the Russian system of government is that the officials are in no way responsible to the people or the courts. If an official offends his neighbor, if he commits a crime, if he robs the treasury or murders an innocent citizen, he is tried by his superior officers in secret and not by a court. The prosecuting witness is not permitted to confront him or to be represented by counsel, and neither he nor the public are permitted to know what has occurred at the trial or what punishment has been imposed. That is the reason why no one is punished for the Jewish massacres. Everybody knows that they were planned and carried out by the police in retaliation for the activity of the Jewish revolutionists. This has been admitted over and over again, but no one has ever been punished. Members of the recent ministry were guilty of revolting cruelties and acts of barbarism, but they were allowed to go without even a reprimand. When I asked why this was permitted, a prominent minister replied that it was impossible to fix the responsibility under the present system of government.

At present any official knows that he will be protected in anything he does, provided his act does not offend the men above him, and can defy the public and the courts. Mr Herzenstein, one of the ablest men in the Empire, the highest authority on financial and economic questions, and of unimpeachable integrity and patriotism, was assassinated last August by a policeman under the orders of his superior officer. It was a deliberate murder, and one of the government organs at Moscow published the news twelve hours before the deed was committed. The assassin's name was Nishikin; he was absolutely identified, but he was never punished, because he was responsible to no court and to no authority except the men who directed him to commit the crime.

It is easily understood why such a condition has not been corrected. The entire bureaucracy of the Empire has been united in defense of their most important prerogative. But until the officials are made responsible to the courts like ordinary citizens, there can be no genuine reform in the Russian civil service.

In the third section of a famous manifesto of October, 1905, the Czar promised

"to make all classes equal before the law and assure the independence of the courts." In the first paragraph he says: "It is the first duty of all authorities in all places to fix the legal responsibility for every arbitrary act, in order that sufferers through such acts shall have legal redress."

To this the douma responded: "The whole Russian people welcomed this message with an impassioned cry, but the very first days of liberty were darkened by heavy afflictions laid upon the land by those who still bar the way of the people to the Czar and trample under foot all the principles of the manifesto; by those who cover the land with sufferings and executions without judicial sentence; with atrocities, fusillades, and with imprisonment."

As I have said already, the spread of socialism among the peasants during the last few years has been going on with amazing rapidity as they learn to read and write and tuck their shirts into their trousers, while a passive revolution under unconscious leaders has transformed almost the entire population of the Russian Empire from submissive subjects to discontented critics of the ministry and the court.

Dissatisfaction with the autocracy has penetrated every stratum of society in every part of the Empire, because of the appalling corruption of the court and the government, the tyranny of the police, the scandalous behavior of the grand dukes, and the general recognition that an autocracy is not consistent with modern civilization. When the armies of Russia were defeated in Manchuria and its navy was destroyed, this universal dissatisfaction was manifested in various forms. The labor unions furnished the motive power, as you might say, and gave an impetus to an irresistible movement, while the "Intellectuals" and the "Intelligencia," as the educated classes are called, followed their lead.

The great strike which stopped every wheel and paralyzed every industry in the entire Empire convinced the Czar that he must do something to satisfy public clamor, and he promised his people a constitution and a parliament. Twenty-three years before his grandfather prepared a plan of limited representation in the government for the people. It was lying on his desk awaiting his signature when he was assassinated, and the clock was turned back twenty-five years. When the time came when something must be done to save the dynasty, in a rescript dated March 3, 1905, Nicholas II said:

"I am resolved henceforth, with the help of God, to convene the worthiest men possessing the confidence of the people, and elected by them to take part in the elaboration and consideration of legislative measures, and with the examination of a state budget."

THE MEMBERS OF THE FIRST DOUMA

A commission under the Minister of the Interior prepared a plan, an awkward and complicated system, which was almost equivalent to universal suffrage; an election was held in March, 1906, and a fairly representative parliament was chosen. There was an upper house composed of ninety-eight members, one-half of whom were appointed by the Czar and the other half chosen by the commercial, industrial, and professional organizations, the faculties of the universities, and the church. The lower house, called the douma, consisted of 440 members, of whom, according to a canvass, 276 were in favor of a reorganization of the government from an autocracy into a limited monarchy, and 164 were in favor of a republic, to be secured by armed revolution if necessary. There was not one supporter of the autocracy in the entire body, and only five of the members refused to vote for the radical and impossible program adopted as a reply to the first speech from the Throne. Those five conservatives did not vote against the address, but left the chamber in order that it might be adopted unanimously.

Twenty-three races were represented in the douma, as follows:

Russians	265
Little Russians	62
Poles	51

Jews	13
White Russians	12
Cossacks	12
Lithuanians	10
Tartars	8
Letts	6
Georgians	5
Germans	4
Vashkirs	4
Armenians	4
Buriats	2
Mordvanians	2
Votiaks	2
Kirghis	1
Circassians	1
Bulgarians	1
Roumanians	1
Kalmuks	1
Chuvas	1
Ossetines	1

Almost every occupation was represented, as follows:

Peasant farmers	56
Boyars, or large land-owners	46
Lawyers	39
College professors	37
Clergymen	27
Managers of large estates	26
Merchants	24
Government officials	24
Capitalists	22
Village officials	21
Factory workmen	17
Physicians	16
Commission men	15
School teachers	14
Army officers	13
Engineers	11
Newspaper men	11
Contractors	9
Bankers	7
Railway men	4
Scientists	3

Every religion in Russia had its representatives upon the floor, as follows:

Orthodox Greeks	322
Roman Catholics	30
Old Believers	20
Jews	12
Mohammedans	12
Protestants	11
Armenians	9
Buddhists	2

One of the most striking figures in the entire assembly was a Roman Catholic archbishop, Monsignor Roop, of Wilna, whose serene face, stately presence, and purple robes made him conspicuous. Seven Mohammedan mullahs, sent up by the Tartars of the Caspian provinces, appeared in their conventional robes and turbans and sat beside several priests of the Orthodox Greek Church wearing long hair and beards and the peculiar hat and veil of their profession. It was therefore a most interesting assembly. It probably contained a greater variety of elements, conflicting and rival, than any other legislative body that ever met—all grades of society, education, and intelligence. Princes sat beside peasants, and mingling with the thirty-seven college professors were six shaggy muzhiks who could not read nor write. The ablest theorists of the Empire and some of the most profound scholars of Europe were sent by the different universities, and the man who controlled the action of the douma, as completely as Speaker Cannon controls the present House of Representatives in Washington, was a member of the faculty of the university of Chicago, Professor Milukoff, a charming gentleman of great learning, of lofty ideals and unlimited benevolence, but entirely without experience in politics or legislative affairs, or practical knowledge of administration.

There were twenty-seven different political organizations, representing every phase of opinion from the ultra-conservative to the red radical; socialists, trades unionists, and other men of fixed purposes and extreme views. The most noisy and conspicuous were professional agitators, socialists and labor reformers, most of whom, although they call themselves "the party of toil," had never earned a dollar by manual labor in their lives. They professed to represent the views of honest farmers and mechanics and had been elected by them, but accomplished nothing and only injured the interests of their constituents.

THE POLITICAL PARTIES

The members of the douma might be divided into three groups, as follows:

Conservatives	60
Moderates	250
Radicals	150

The principal parties were, first, the Octoberists, so called because they were elected upon pledges to support the manifesto issued by Nicholas II in October, 1905, in which he promised his people a constitution, a parliament, free religion, free speech, and all that is meant by civil and political liberty. This party was composed chiefly of business and professional men from the great cities, land-owners, and men of large affairs. Their numbers were limited, and they came nearer than any other class to support the government. Stolypin, the present Prime Minister, was one of the leaders of the Octoberist party. His brother is still the secretary of its executive committee and one of the editors of its newspaper organ. Generally speaking, the Octoberists advocated a limited monarchy similar to Germany, and a broad, liberal system of education. They demanded a reorganization of the entire government, the reform of the judiciary, and almost universal suffrage.

The Constitutional Democrats in their platform demanded all this and more, including a ministry responsible to the parliament rather than to the Czar. They would be satisfied with a government like that of Great Britain.

The Constitutional Democrats controlled the douma because they had a majority of its members, and if they had adopted a rational and practical program and carried it through, they would have accomplished great things for Russia; but, from the beginning, they committed blunder after blunder and threw away every one of the many golden opportunities that were offered them. They should have shown some gratitude to the Czar for the constitution he had given them and for other concessions he had made, and encouraged him to make more; but, instead of adopting a conciliatory policy, they bullied his ministers and accused him of insincerity. In order to avoid controversies among themselves they made concessions to the socialists and revolutionists and allowed the most radical members of those parties to control the proceedings of the douma. Their generosity was suicidal. They seemed to think that they must present a solid front to the autocracy. They sacrificed everything for the sake of unanimity and loaded down their program with wild and impracticable propositions. It was a pitiful display of incapacity. When the leaders were criticised for yielding to the radicals, they would explain that the fundamental principles of their doctrine was freedom of thought and freedom of speech, and what right had they to object to the opinions of a fellow-being? No such Utopian policy was ever known in a legislative body before. No such generosity was ever extended before by one political party to another, and it not only impaired the usefulness of the "Cadets," as the Constitutional Democrats were called, for short, but proved their destruction.

The Social Democrats were next in numbers, and their platform was purely socialistic, based upon the theory that differences in wealth and station are wrong, and that all authority and all law are violations of the rights of man. They want a republic in Russia. So do the Social Revolutionists, who would accomplish the same thing by violence and are responsible for the bomb-throwing, the assassinations, the mutinies, the destruction of property valued at hundreds of millions of dollars, and other crimes against individuals and society in carrying on their propaganda. The members of this party defy all law; they trample upon all rights. They are vindictive, cruel, and merciless. They are anarchists, nihilists, and terrorists, but are always willing to die with their victims. The nerve and stolidity of the Russian revolutionists were never surpassed by any human beings. They do not seem to have the slightest fear of death and are utterly indifferent to danger. Their boldness is amazing. Very few bomb-throwers have escaped alive, and no member of the fighting group of the Social Revolutionist party has broken down or even faltered in the presence of the hangman.

UNPROFITABLE DISCUSSIONS AND IMPOSSIBLE DEMANDS

Considering the material of which it was composed, the douma displayed a remarkable amount of patience and self-control, although its time was wasted in unprofitable discussions and its demands upon its sovereign were unreasonable and impossible to grant. But that was perfectly natural. A dozen or more of the leaders had suffered banishment to Siberia; as many more had been imprisoned in dungeons for conscience's sake; two-thirds of the entire body had suffered injury or humiliation in one form or another from the government because of their political views. One of the peasant members had been beaten almost to death, as his maimed and crippled body bore witness, because he had been brave enough to present the complaints of his village to the governor of his province.

The douma was in session 119 days and it passed two bills, both of them of the greatest significance. One abolished the death penalty, and every member on the floor felt a vivid personal interest in that legislation; the other provided for the appointment of a commission to supervise the expenditure of the famine relief fund, which was a fortunate thing, because the Assistant Secretary of the Interior, one of the worst men in Russia, is now under investigation for pilfering from that fund.

Until the douma met, the people of Russia had never been allowed to express their opinions, and the repression of a thousand years was relieved at its sessions. Speech is a safety-valve for an overcharged mind, elsewhere as in Russia, and the outbreaks of enthusiasm and indignation were no more boisterous than I have seen in our own Hall of Representatives, and, compared with other legislative assemblies of Europe, the proceedings of the douma were orderly and decorous. But, unfortunately, instead of protecting its own rights and insuring its own existence; instead of passing laws to gratify the land-hungry peasants; to provide election machinery; to make government officials responsible to the courts; to reorganize the judiciary and the police; to establish a system of education and other important measures, the time was wasted in abusing and baiting the ministers and in high flights of oratory. The Extremists ruled because they were the most aggressive; the Conservatives submitted in order to promote harmony and present an unbroken front of opposition to the autocracy. Finally a minority, under the lead of the Radicals, overstepped the bounds of decency and passed a resolution false in statement, wrong in spirit, intemperate in terms, warning the people that they could not trust the Czar or his officials. Only about one-third of the members voted for it, the Radicals and the Revolutionists; but the Conservatives and moderate members would not vote against it, because they were afraid of the Extremists. They retired from the chamber; but the effect was the same, and the Czar exercised his right to dissolve a mutinous and disloyal parliament, just as the German Emperor, for even less reason, dissolved the Reichstag December 12.

NICHOLAS' LOST OPPORTUNITY

But there had been no sympathy between the two powers from the first, and if the douma was guilty of many blunders, he was guilty of more. His list of lost opportunities is longer than that of any ruler in modern times. If he had received the members of the douma with kind words and a conciliatory disposition, he might have won over a large number of them to the support of his own policy or program without relinquishing a particle of his dignity or authority; but on the day it met he practically repudiated the body he had himself created. Hence the Czar had no friends or supporters in the lower house, and the upper house, composed one-half of men of his own choice, was also against him.

Unfortunately for himself and for his country, Nicholas II is always wavering between right and wrong. If he goes wrong, he acts promptly; if he does right, he delays his action so long that he loses

all the credit he deserves. On the 3d of March, 1905, he promised his people a constitution, but it was not until the 10th of May, 1906, that the promise was fulfilled. In the meantime revolutionary horrors increased, deputations came to beseech him to carry his purpose into effect; but he would do nothing until the creditors of the Empire compelled him to act, in order that he might obtain a loan of four hundred million dollars to settle the accounts of the war and bring the army back from Manchuria. The creditors of the Empire compelled him to keep his pledge and refused to advance another dollar until a parliament had been elected and the draft of a constitution or fundamental law was submitted for their approval.

It was not a liberal constitution, but was more than might have been expected. It was a long step in advance, and it gives as much self-government as the people of Russia are capable of exercising; perhaps more. They have had no experience; the masses are densely ignorant; only one out of four can read and write; 70 per cent of the population do not have the slightest comprehension of what self-government means. The Emperor of Japan voluntarily relinquished the autocratic power that had been exercised by his ancestors for more than 2,500 years; the Empress of China has recently taken the first step toward a similar concession; the Shah of Persia has conceded a parliament which will share with him the responsibility of government, and, as long as Nicholas II was compelled to give his people a constitution in order to save his throne, one might suppose that he would have made a virtue of necessity and gained as much credit as possible for the act; but he lost all that he might have gained, and what is even worse and more lamentable, he has destroyed the faith of the people in his sincerity and has forfeited their respect by permitting the letter and the spirit of his constitution to be violated by his own officials almost every day since it was proclaimed.

The Czar has many good impulses; he has frequent lucid intervals; sometimes he shows a wise and generous spirit. Three times during the douma he offered the Liberals an opportunity to form a ministry, and if the leaders of the Constitutional Democratic party had possessed a particle of common sense, they would have met him half way and accepted his olive branches. The first time he offered them the administration of the government they rejected his overtures in the most contemptuous manner they could devise. The second time they gave the matter serious reflection and discussed it for several days. Finally they agreed to accept, but adopted a program so preposterous and absurd that their reply was not worthy of attention. They would not be content with gradual reform; they insisted that everything should be done in an instant. They were so foolish as to attempt to transform an absolute despotism into a liberal monarchy by the stroke of a pen.

James Russell Lowell, writing of Spain, said:

> "Institutions grow and cannot be made to order; they grow out of an actual past and are not to be conspired out of a conjectural future. Human nature is stronger than any invention of man. When party leaders learn that an ounce of patience is worth a pound of passion. Spain may at length count on that duration of tranquillity, the want of which has been the chief obstacle to her material development."

Elihu Root, in his address to the third Conference of American Republics, at Rio de Janeiro, July 31, 1906, said:

> "Not in one generation, nor in one century can the effective control of a superior sovereign, so long deemed necessary to government, be rejected, and effective self-control by the governed be perfected in its place. The first-fruits of democracy are many of them crude and unlovely; its mistakes are many; its partial failures many, its sins not few. Capacity for self-government does not come to man by nature. It is an art to be learned, and it is also an expression of character to be developed among all the thousands of men who exercise popular sovereignty."

If the leaders of the first Russian parliament could have realized the profound

truth of those axioms, and had they been willing to allow a gradual development of democratic ideas and liberal forms of administration, they might have had the opportunity to guide and control the regeneration of Russia; but they would not listen to reason; they demanded all or nothing. When I asked Professor Milukoff, their leader, why they did not accept what they could get and wait in patience for more, he replied:

"Would you have insulted your revolutionary fathers with such a cowardly suggestion?"

A CARNIVAL OF CRIME AND ASSASSINATION

For several weeks after the dissolution of the douma last August, Russia saw a carnival of crime, assassination, and violence such as never occurred before, even in the bloody history of that empire. The week I spent in Warsaw twenty-two policemen were killed on their beats, and not one of the assassins was detected. There were mutinies in the army and the navy. You will remember how the fortresses at Cronstadt and Helsingfors were seized and the terrible slaughter that attended those incidents. One of the Petersburg papers, edited by Professor Kovaleski, enumerated the assassinations and gave an amazing estimate of the mortality. It declares that 7,300 persons were killed and more than 9,000 were wounded by bombs in massacres and mutinies. Among the killed were 123 governors, generals, chiefs of police, and other high officials. Thirty thousand revolutionists were arrested and most of them were sent to Siberia, while 221 persons were executed. Twelve railway trains containing government treasure were held up and successfully robbed, 400 government liquor stores were robbed and destroyed, and $630,000 of government money was stolen by burglars and highwaymen. All of this was done by the revolutionists.

According to the authority of the "Retch" newspaper, the organ of the Constitutional Democratic party, one member of the late douma has been assassinated, one has become insane, two of the peasant members (Mr Stevanduk and Mr Grevoff) have been beaten nearly to death because they did not accomplish anything for their constituents. Onipko, a most repulsive person and the leader of the terrorists in the douma, has been sent to Siberia. He was captured red-handed, leading the mutiny at Cronstadt. Five members of the douma have been banished; the houses of thirty-three have been searched; twenty-four have been imprisoned for political reasons; 182 have been deprived of civil rights and are under indictment for having conspired to induce the people to disobey the law. These were the members of the douma who signed what is known as the "Protest of Viborg" against the dissolution of the douma and appealing to the people not to pay taxes or to serve in the army. This was a very foolish procedure, because there are no direct imperial taxes in Russia. The revenues of the government come from indirect duties paid upon liquor, from duties on imported goods, from monopolies, and similar sources. The manifesto, therefore, did not injure the general government, but only the local "zemstovs" and "mirs," who collect taxes for schools, roads, and other purposes. The men who signed that protest, 218 in number, might have been held for treason, but the government merely indicted them for conspiracy, and thus made them ineligible for re-election to the douma. About one-half of them belonged to the Constitutional Democratic party and the remainder to the Social Democrats, Social Revolutionists, and other radical organizations. The Constitutional Democratic party, however, is held responsible for the manifesto; its meetings are prohibited notwithstanding the guarantee of free speech in the constitution, and the Emperor's October manifesto. It has been practically dissolved by proclamation, but has nominated candidates against whom the government can find no objection and is carrying on an active campaign.

The more conservative element have organized what they call the "Party of Peaceful Regeneration." It consists of

those who refused to sign the Viborg protest, and their platform condemns their former associates for their uncompromising opposition to the government and their alliance with the revolutionists.

Another new party is called the "Progressive Reformers," but its platform differs little from that of the Octoberists. It advocates a form of government similar to that of Germany, with a ministry responsible to the sovereign, but in harmony with the parliament. Mr Stolypin is a member of the Octoberist party and a sincere believer in parliamentary government, but has never declared himself on the question of ministerial responsibility.

THE GOVERNMENT'S ATTEMPT TO ELECT A SECOND DOUMA WHICH IT COULD CONTROL

The first douma was elected by practically universal suffrage. Almost every man in Russia twenty-four years of age and older was able to participate, which was a mistake, because the illiterate and ignorant millions by the volume of their votes controlled the result. This time Stolypin is determined to get a practical and reasonable douma, and in order to do so is using arbitrary measures. He is fighting fire with fire and force with force. He is disfranchising the revolutionary forces wherever he has an excuse. This is not done directly, but by the Senate, which corresponds to the Supreme Court of the United States and whose duty is to interpret the laws. He has stated frankly that if he does not succeed in getting a douma that will coöperate with him in the reorganization of the government and the reforms he is now carrying out, it will be dissolved and another election will be ordered with still greater restrictions.

Stolypin has instructed all provincial officials to use their best efforts in support of the Octoberist candidates, and in districts where they have no chance, to help the "Peaceful Regenerationists" or other conservatives. The result depends upon the votes of the peasants, who have always been loyal to "The Little Father," as they affectionately call the Czar. At the previous election they were controlled by socialistic agitators, itinerant apostles of anarchy and violence, most of whom were non-residents and were elected to the douma because they promised to accomplish all sorts of impossible reforms. Stolypin is trying to eliminate such leaders from the campaign and to keep professional agitators like Alladin out of parliament. To do this the Senate has construed the election law so that only persons with fixed homes can vote or be voted for, and non-residents are prohibited from taking part in the campaign.

This disfranchises several hundred thousand workmen who participated in the last election because they have migrated from the country to the manufacturing centers. The Senate has also debarred 278,000 employees of the government railways, postal service, and workmen in the government shops, including the most skilled and highest-paid labor in Russia, such as locomotive engineers, stationary engineers, machinists, and draftsmen. The reason, frankly given, is that these classes of workmen are too easily influenced by agitators. It is a wonder that the order was not followed by strikes.

Another edict, issued November 11, forbids officers and soldiers of whatever rank to join political parties, or to attend political meetings or to discuss political questions, and disfranchises every man in the military service.

Civil employees of the government who join or assist either of the revolutionary parties forfeit their positions and all claims to pensions. This includes school-teachers and university professors, nearly all of whom belong to the liberal or revolutionary parties.

The students in the universities are debarred because they are all revolutionists. A recent canvass of the University of Odessa illustrates the political sentiments of the students:

Social Democrats	777
Social Revolutionists	712
Octoberists	317
Constitutional Democrats	167

Labor Reformers	167
Total against government	1,823
Total for government	317

In some of the universities the students are unanimous against the government. Every one of them is a revolutionist, and because they insist upon holding revolutionary meetings, making revolutionary speeches, and singing revolutionary songs in the buildings and on the campus, the government has closed all of the nine universities in Russia and scattered between fifteen and twenty thousand agitators throughout the land, when it might have kept them segregated, where they would do no harm.

Although the October manifesto of the Emperor and the constitution of Russia guarantee free speech, free press, and the right to hold political meetings, the government has suppressed a large number of newspapers and has compelled the publishers of those which are allowed to exist to sign an agreement not to advocate revolutionary doctrines, nor excite the people by attacking the arrangements for the approaching elections, or criticising the acts of the ministry. Mr Stolypin considers it his duty to preserve the peace and suppress opinions and utterances that are likely to cause disturbances. He has announced that the government will not hesitate "to demand that its officials employ all legal measures to prevent the transformation of instruments of progress and peace into instruments of violence and destruction." He has adopted the same restrictive measures toward the reactionaries and is quite as unpopular with them as with the revolutionists. He treats both alike. All extreme opinions or measures are offensive to him. When "The League of Russian Men," an organization supporting the autocracy, asked him for 100,000 roubles to pay the expense of carrying on a propaganda in support of the Czar and the ministry, he refused to give them a kopeck; whereupon they passed a series of resolutions denouncing him as a usurper of authority, as a traitor to his sovereign, and declared that his program of reforms was treasonable and an infraction of the divine right of the autocrat. Apparently the Czar, to whom these resolutions were addressed, has taken no notice of them.

Mr Stolypin justifies his vigorous campaign of restriction, in suppressing revolutionary newspapers and shipping revolutionists to Siberia by regiments, on the ground that all enemies of the state should be prevented from accomplishing their designs by any measures that may prove effective; that the revolutionary organizations, by inciting mutinies in the army and navy and disturbances among the peasants; by robbery, assassination, and other crimes and violence, have placed themselves beyond the protection of the constitution and the October manifesto, and are ordinary criminals; that as long as revolutionary leaders are admitted to the douma they will destroy the usefulness of that body. Therefore it is his duty to keep them out and secure the election of practical, honest, and patriotic men. He contends that there can be no genuine reforms so long as the revolutionary element are allowed a free hand in politics. They are responsible for the industrial and financial depression in the Empire by disturbing public tranquillity. They desire to destroy. They do not want to build up. They are men of no character, no property, no interest at stake; the enemies of society, anarchists, adventurers, fanatics, without the slightest comprehension of the science of government or the meaning of the word "liberty."

THE PUBLICATION OF REVOLUTIONARY BOOKS AND PHOTOGRAPHS NO LONGER INTERFERED WITH

Although public meetings are broken up by the police every day, newspapers are suppressed, and innocent people as well as wicked conspirators are arrested for political reasons, there has been a remarkable change in Russia, and especially in Saint Petersburg, within the last few months. Formerly every printed book and manuscript found in the bag-

gage of a traveler was closely examined and usually seized, in the effort to prevent the dissemination of revolutionary literature. Nowadays manuscripts, books, and pamphlets are passed without question. You can buy revolutionary music, photographs, and post-cards on the streets and at the news-stands. You can find all kinds of newspapers, including the most radical organs of the socialists, upon the files in the reading-rooms of the hotels, and cartoonists are taking amazing liberties with public men and public questions in the comic papers. If such caricatures had been printed two years ago both the artist and the publisher would have gone to a dungeon. Boys on the street are selling photographs of "Martyrs for Liberty"—Polish Jews who have thrown bombs and assassinated officials, revolutionists who have been killed by the police or executed for political offenses, and the leaders of the mutinies at Cronstadt, Helsingfors, and Sevastopol. One of the most popular and profitable photographs represents William Jennings Bryan sitting in the center of a group of the reddest socialists and anarchists in Russia. It was taken on the steps of Tauride Palace during a session of the douma and has done incalculable harm, because it has convinced many honest workingmen that Mr Bryan and the people of the United States sympathize with the bomb-throwers and anarchists.

The mails are no longer interfered with; the censors have been discharged. Foreign newspaper correspondents can criticise the government as much as they like and send their dispatches over the official telegraph lines.

PREMIER STOLYPIN IS ABLE AND BRAVE

Russia has been more tranquil during the last three months than for three years previous. The great strike that was arranged by the socialists as a protest against the dissolution of the douma did not come off, because the workingmen would not obey the instructions of the politicians. The uprising of the peasants which was to occur after the crops had been gathered was indefinitely postponed and few estates have been destroyed recently. No more massacres will be permitted, because Mr Stolypin knows how to prevent them and is determined to do so. There was no unfriendly demonstration toward the government on October 30, the first anniversary of the manifesto which offered liberty to the people and promised many blessings that have not been bestowed. Robberies and murders in Poland have not been so frequent of late. Mr Stolypin has introduced more reforms during the last three months than were ever known in any previous administration. He has taken a sensible view of the situation. He recognizes that the people have been wronged and have grievances that should be redressed. He has tried to see both sides of the situation, and not long ago declared the opinion that "men who are compelled to live on one herring and three potatoes a day cannot be expected to understand the benefits of an autocracy or the obligations of citizenship." He referred to the starving Jews, and while he did not feel at liberty to grant them the full rights enjoyed by other subjects without the concurrence of the douma, he has relieved them from the most severe of the restrictions under which they have been suffering, and now they can go about Russia with an ordinary passport. They may engage in any business, but are not yet allowed to buy land outside the pale of settlement. Jewish children are now admitted to all the schools and universities of Russia without condition. The members of that race are now enjoying nearly all the liberties of those of other races and religions, except that there has been no change in passport regulations, which has been promised from year to year. Foreign Jews are still compelled to explain the object of their visit before they are permitted to pass the boundary. Mr Stolypin will undoubtedly remove that humiliation in due time.

THE VENGEANCE OF THE JEWS

Perhaps these reforms are the cause of the present tranquillity, because the revo-

lutionary leaders nearly all belong to the Jewish race and the most effective revolutionary agency is the Jewish Bund, which has its headquarters at Bialystok, where the massacre occurred last June. The government has suffered more from that race than from all of its other subjects combined. Whenever a desperate deed is committed it is always done by a Jew, and there is scarcely one loyal member of that race in the entire Empire. The great strike which paralyzed the Empire and compelled the Czar to grant a constitution and a parliament was ordered and managed by a Jew named Krustaleff, president of the workingmen's council, a young man only thirty years old. He was sent to the penitentiary for life, and had not been behind the bars more than three weeks when he organized and conducted a successful strike of the prison employees.

Maxim, who organized and conducted the revolution in the Baltic provinces, is a Jew of marvelous ability. Last fall he came over here lecturing and collecting money to carry on the revolutionary campaign, but for some reason has vanished and nobody seems to know what has become of him.

Gerschunin, the most resourceful leader of the terrorists, who was condemned to life imprisonment in the silver mines on the Mongolian frontier, has recently escaped in a water cask, and is supposed to be in San Francisco. He is a Polish Jew only twenty-seven years old. I might enumerate a hundred other revolutionary leaders and every one of them would be a Jew. Wherever you read of an assassination or of the explosion of a bomb you will notice in the newspaper dispatches that the man was a Jew. The most sensational and dramatic episode that has occurred since the mutinies was on October 27, when, in the very center of Saint Petersburg, at the entrance of Kazan Cathedral, four Jews held up a treasury wagon and captured $270,000. They passed the package to a woman, who instantly vanished, and no trace of her has ever been found; but they were all arrested and were promptly punished. On the 8th of November a few Jewish revolutionaries entered a treasury car near Ragow, in Poland, got $850,000, and disappeared.

Every deed of that kind is done by Jews, and the massacres that have shocked the universe, and occurred so frequently that the name "pogrom" was invented to describe them, were organized and managed by the exasperated police authorities in retaliation for crimes committed by the Jewish revolutionists.

MANY REFORMS ALREADY INSTITUTED BY PREMIER STOLYPIN

But Mr Stolypin has evidently arranged a truce. He has crushed out the conspirators in the police department who organized and directed the "pogroms" and has given the Jews more liberty and more justice than they ever enjoyed before. He has appointed a commission to prepare a law placing them upon the same footing as Protestants, Roman Catholics, and members of other religious faiths.

Mr Stolypin is an able, honest, and grave man, of broad horizon and liberal views and a high sense of justice. He has already done wonders. Every week some important reform is ordered, some tyrannical regulation revoked, some liberty conferred, some concession granted. He has emancipated the heretical sect of the Orthodox Greek Church known as the "Old Believers," who have been persecuted almost as cruelly as the Jews. They are now allowed to own property and build schools and publish books containing their doctrines; they are allowed to marry without the sanction of the Orthodox Church; their sons are admitted into the military schools and are eligible to positions in the civil service.

Stolypin has also removed the ban which prevented peasants from entering the civil service, which is one of the most striking departures from the traditional regulations of the autocratic régime. He has removed all distinctions concerning appointments under the state.

He has endeavored to bring the peasants to the support of his administration by hastening the distribution of land which they have so long and so earnestly demanded. He has appointed a commission to survey, appraise, and allot the crown and state lands as fast as leases expire or can be canceled. He has purchased a number of large estates from private proprietors who were willing to sell and is trying to settle the land question himself before the new douma can take it out of his hands.

He has remitted to the peasants their arrears in payment for lands now occupied and for back taxes to the amount of $37,500,000. He has issued a law permitting peasants to mortgage their lands to obtain money for improvements, for the purchase of implements, and for obtaining additional land. To prevent extortion, the transaction must be conducted with government banks and the rate of interest is fixed.

After January 1 peasants may select their own residences, which has never been permitted before. They can live where they like and move about the Empire at pleasure. Heretofore they could not leave their birthplaces without the permission of the elders. He has released them from the communal system, which was tyrannical, and has relieved individuals from responsibilities for the debts of the community. Peasants may now enter educational institutions and obtain civil employment without presenting discharge papers to show that they have done military service. In other words, all Russian subjects of whatever rank or station, of whatever religion or race, have been placed upon an equality.

Stolypin has reduced the working day of employees in government shops from twelve to ten hours; he has a commission engaged in drawing up a broad system for universal primary education which will involve an expenditure of $103,000,000 annually. He has made a grant of five million roubles, chargeable to next year's budget, for the erection of school-houses in the rural districts, and has issued an order to the education department to increase the salaries of school-teachers.

In addition to these reforms already granted, Mr Stolypin is preparing a number of important measures which will be laid before the douma when it meets. Many of them are intended to specify the rights, liberties, and privileges granted by the Czar in the fundamental law or constitution proclaimed on the 10th of May last. These concern politics, the press, public meetings, and are generally liberal, but prohibit personal abuse and intemperate criticism of the government. There are several laws in preparation for the benefit of the working classes, including state insurance, the liability of employers for accidents, and other measures borrowed from Germany. It is proposed to increase the revenues by an income tax on the same basis as that of England, and by making the importation and sale of tea a government monopoly, like the manufacture and sale of liquor. In case a moderate and conservative douma is elected Mr Stolypin will submit the draft of a law bringing the officials of the government within the jurisdiction of the courts, which will destroy the most vital prerogative of the bureaucracy.

THE GRAND DUKES HAVE YIELDED TO THE INEVITABLE

There is no evidence that the grand dukes or other reactionaries are interfering with these reforms; I have the highest authority for saying that the Empress Dowager and the Grand Duke Vladimir approve them, and if the Czar permits them to be carried out he may recover the confidence and the loyalty of his subjects. When a ruler has lost his faith in his people, and a people have lost faith in their ruler, the case is almost hopeless. Everybody in Russia agrees that the autocracy must go; even the imperial family admit that it is out of fashion and inconsistent with modern civilization. However, it is perfectly

natural that the Czar of all the Russias should object to the surrender of his power and prerogatives, inherited from a long line of autocrats. But sooner or later he will be divested of them. Already, as you have seen, many of them have been stripped off. His weakness, however, is the safety of the Empire. Every thoughtful man among the Liberal party prays, if he prays at all, that the life of Nicholas II may be preserved, for his vacillation and indecision furnish an elasticity that is like a spring in the bumpers of a railway car to soften the shock of frequent collisions between the people and the autocracy. In other words, the Liberal leaders believe that it is much better for the present peace and the future welfare of Russia to have a weak man rather than a strong man to deal with, and that his frequent changes of policy and his infirmity of purpose will serve them better than the stubborn resistance of a stern and determined sovereign, as his father was.

Although the Czar is a voluntary prisoner, his life is not in danger, except from some insane assassin. Nevertheless there is an always-present apprehension of danger.

His Majesty's proclamation dissolving the douma was pasted upon the door of the Tauride Palace, in which the parliament met, and was signed in large letters with His Majesty's name. Some irreverent person, with the spirit of prophecy, erased the signature "Nicholas II" and inserted "Nicholas the Last."

THE SECOND DOUMA

The second douma was elected in February, 1907, and organized in the month following. By the arbitrary restriction of the right of suffrage to certain classes, the government reduced the Radical majority considerably, and secured the election of about thirty reactionaries or absolute monarchists. During the first month of the session the proceedings were much more moderate and businesslike than those of the first douma, and, on the other hand, Mr Stolypin and his associates showed a conciliatory disposition toward that body in striking contrast with the attitude of the previous ministry. The Constitutional Democrats, however, who, with the assistance of the Radicals, have an overwhelming majority, are inclined to insist upon the same sweeping reforms that were demanded by the first douma, and at this writing do not promise any practical or useful legislation.

It is useless to predict what will happen in Russia; but the autocracy is ended. A constitution and a parliament have been given to the people and cannot be recalled. It is one of the great mysteries of Providence, which our feeble minds have never been able to solve, that human liberty must be bought with suffering and blood; but it would seem as if we were entering upon a new period. There has been comparatively little bloodshed in Russia, and in China and Persia a peaceful regeneration of their governments is going on. The year 1906 will ever be memorable in the history of civilization because it has seen the dissolution of three despotisms and the establishment of representative governments upon their ruins. Only two despotisms still remain among the nations of the earth—Siam and Turkey; but the King of Siam has an American adviser, and the Great Turk dare not go outside the walls that inclose his palace.

Cossack Immigrants, of whom about 5,500 were admitted in 1906

SOME OF OUR IMMIGRANTS

THE following series of illustrations, showing different types of the immigrants who are now pouring into the United States in even greater numbers than in 1905 and 1906, were obtained through the courtesy of Hon. F. P. Sargent, Commissioner General of Immigration. The immigrants were photographed immediately after disembarking, and are here shown just as they landed, most of them being still clad in their native costume, which will be discarded, however, within a few hours.

No migration in history is comparable to the great hordes that have crossed the Atlantic during the past 20 years to enter our territory. In 1905, 1,026,499 immigrants were admitted; in 1906, 1,100,735, and in the present year the total will exceed the record of 1906 by many thousands. Since June 30, 1900, 6,000,000 have been admitted, of whom probably 5,500,000 have settled permanently in the United States.

The report of Mr Sargent for 1906, recently issued, contains much interesting information about the character and qual-

A German Family of One Daughter and Seven Sons

While the proportion of Germans arriving is much less than in former years, considerable numbers are still seeking the United States, the total in 1906 being 86,813. Less than one-half of these, 37,564, came from Germany

A Scotch Family of Seven Daughters and Four Sons

The United Kingdom sent us 102,193 immigrants in 1906, as follows: England, 49,491; Ireland, 34,995; Scotland, 15,866; Wales, 1,841. More than two thirds of our total annual immigration are men and boys, the figures for 1906 being 764,463 males and 336,272 females

Typical Russian Hebrew Family

153,748 Hebrews were admitted in 1906. This year the number will be greater. They come principally from Russia

Finnish Girl

Russian Sisters

14,000 Finns arrived in 1906. The Russian Empire contributed 215,665 of our immigrants in 1906, most of them being Hebrews

Finnish Family

Alsace Lorraine Girl

Polish and Slovak Women

135,000 of these people were admitted in 1906

Ruthenian Girl

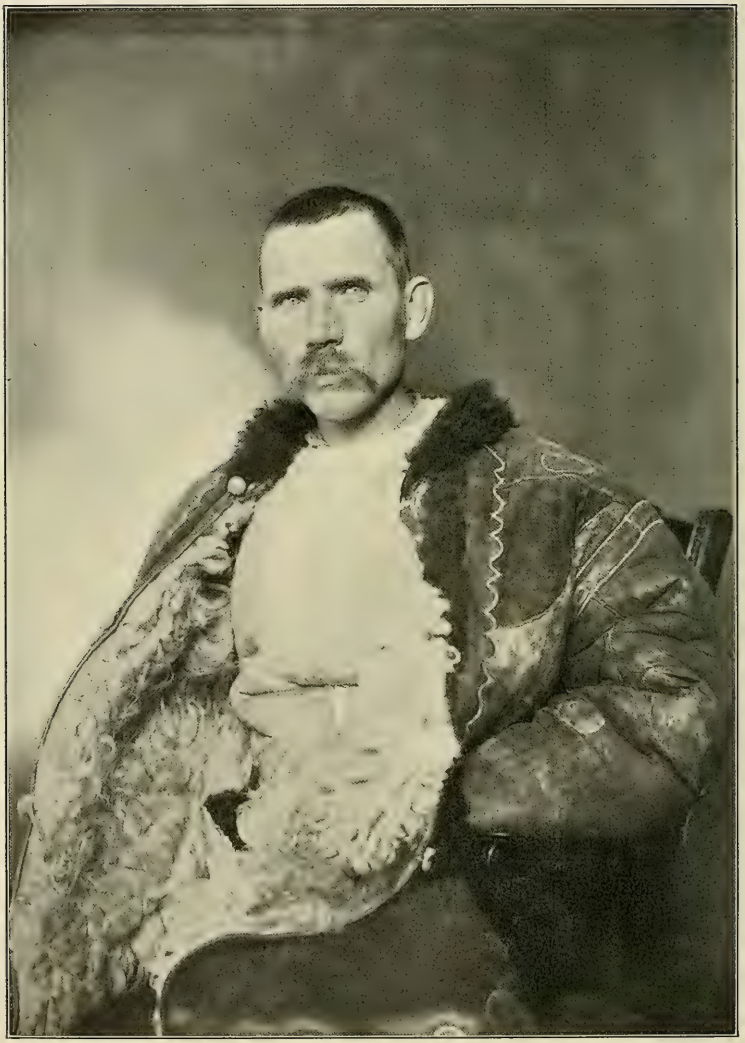
Typical Southern Italian Girl

286,814 Italians arrived in 1906, of whom 240,528 were from Southern Italy and Sicily. The Ruthenians come from Galicia, in Austria-Hungary, and numbered 16,257

Holland Children

Holland Women

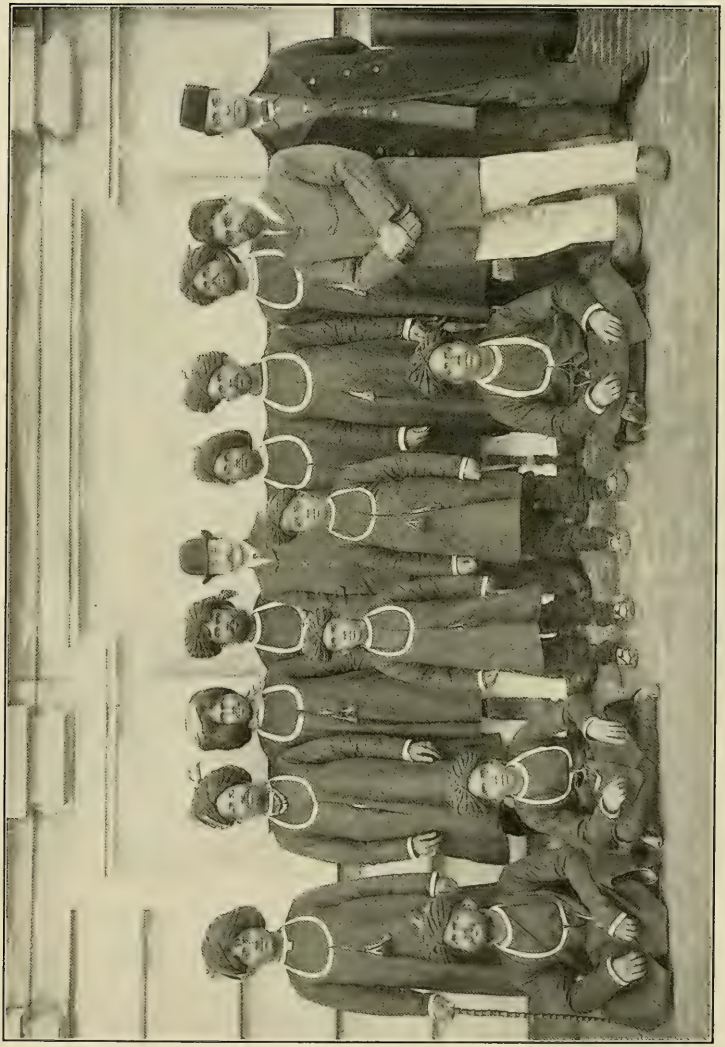
About 5,000 of these people arrive yearly



Typical Roumanian Peasant

Little Roumania sent us 4,500 of her men and women in 1906

Roumanian Shepherd's Family as They Appeared on landing in New York



Hindoos and Parsees

Less than one hundred arrived last year

Arabs

Only a few representatives of this people come to the United States

ifications of the immigrants. Perhaps the most striking fact is that less than 5 per cent of the newcomers have reached or passed the age of 45. Of the arrivals in 1906, 913,955 ranged in age from 14 to 44, 136,273 were less than 14 years of age, and only 50,507 had reached or passed the age of 45. More than two-thirds of the immigrants were males, the figures being 764,463 men and boys and 336,272 women and girls.

About 28 per cent of the total number were illiterate, which is a very large proportion when we consider that only 6.2 per cent of the total white population of the United States and only 4.6 per cent of the native-born whites in 1900 were illiterate.

The immigrants brought to the country cash amounting to $25,109,413. It is exceedingly interesting to note the difference in financial condition between certain of the races. For instance, while the number of Hebrew aliens admitted was more than three times as great as the number of English, the former brought $2,362,125 with them and the latter $2,610,439, while the 144,954 Germans and Scandinavians brought $5,091,594; the 263,655 South Italians and Greeks brought only $4,183,398, and while 16,463 Scotch were able to show $820,759, more than twice as many members of the Slovak race produced only $526,028.

There were debarred during the year 12,432 aliens, of whom 2,495 belonged to the Hebrew race, 2,121 to the Italian,

Hungarian Family

1,000 to the Polish, and 1,867 to the German.

More than one-third of the entire number of immigrants—374,708—stated that they intended to stay in the State of New York, while one-sixth of them—198,681—asserted that they were going to Pennsylvania; 86,539, or about one-twelfth, were avowedly destined to Illinois; 73,863 intended to reside in Massachusetts, and 58,415 were en route to New Jersey; 880,036 entered through New York, 62,229 through Boston, 54,064 through Baltimore, 23,186 through Philadelphia, 6,201 through Galveston, and 2,051 through New Orleans.

Immigrant Aliens Admitted into the United States, by Countries, During the Fiscal Year Ended June 30, 1906

Austria	111,598
Hungary	153,540
Belgium	5,099
Bulgaria, Servia, and Montenegro	4,666
Denmark	7,741
France, including Corsica	9,386
German Empire	37,564
Greece	19,489
Italy, including Sicily and Sardinia	273,120
Netherlands	4,946
Norway	21,730
Portugal, including Cape Verde and Azore Islands	8,517
Roumania	4,476
Russian Empire, and Finland	215,665
Spain, including Canary and Balearic Islands	1,921
Sweden	23,310
Switzerland	3,846
Turkey in Europe	9,510
United Kingdom:	
England	49,491
Ireland	34,995
Scotland	15,866
Wales	1,841
Other Europe	48
Total Europe	1,018,365

Servian Gypsies

Children's Roof Garden, Ellis Island

Here the immigrant children, who are temporarily detained, romp and play until their parents or guardians come for them

Excluded Gypsies about to be Deported

China	1,544
Japan	13,835
India	216
Turkey in Asia	6,354
Other Asia	351
Total Asia	22,300
Africa	712
Australia, Tasmania, and New Zealand	1,682
Pacific Islands, not specified	51
British North America	5,063
British Honduras	80
Other Central America	1,060
Mexico	1,997
South America	2,757
West Indies	13,656
United States	32,897
All other countries	115
Grand total	1,100,735

The new immigrant law, which goes into effect July 1, contains important restrictions which will enable the immigrant officials to debar imbeciles, weak-minded and other undesirable classes with greater effectiveness than in the past. It also contains a provision preventing the entrance of children under 14 years of age unless accompanied by, or plainly intended for, the parent or guardian. The law also increases the head or entrance tax on each immigrant from $2 to $4.

While the law defines more sharply the undesirable classes, it is doubtful if it will reduce the number of immigrants now seeking our land.

THE BLACK REPUBLIC—LIBERIA*

By Sir Harry Johnston and U. S. Minister Lyon of Monrovia

IT will be seen on the map that Liberia occupies a most important strategic position on the west coast of Africa between 5° and 8° north latitude. The general trend of the coast, which is about 400 miles long, is from northwest to southeast, parallel to the course taken by steamers plying across the Atlantic between Europe and South Africa. It might, in fact, in the hands of a strong naval power, exercise a very dominating influence over the eastern Atlantic, which is one reason, among many others, why Great Britain desires to see the independence of the Liberian Republic preserved and maintained.

The country of Liberia as a whole is one dense forest. It is practically the culmination of the West African forest, the regions to the north, east, and west having been more extensively cleared by man in past times, or partaking more of the park-land, grass-grown character, owing to their less copious rainfall. Now that two English companies, in conjunction with the government of Liberia, are endeavoring to develop the resources of the interior and to accumulate knowledge regarding the climate and products, attempts are being made to record the rainfall, as to the extent of which at present only a guess can be made. It is probable that south of latitude 8° 30′ the average annual rainfall of Liberia is not less than 100 inches. Adjoining regions in Sierra Leone have a recorded rainfall of something like 130 inches, so that this is probably an under rather than over estimate. North of latitude 8° 30′ the rainfall diminishes to probably 60 to 80 inches per annum, and in consequence the dense forests give way to a pastural coun-

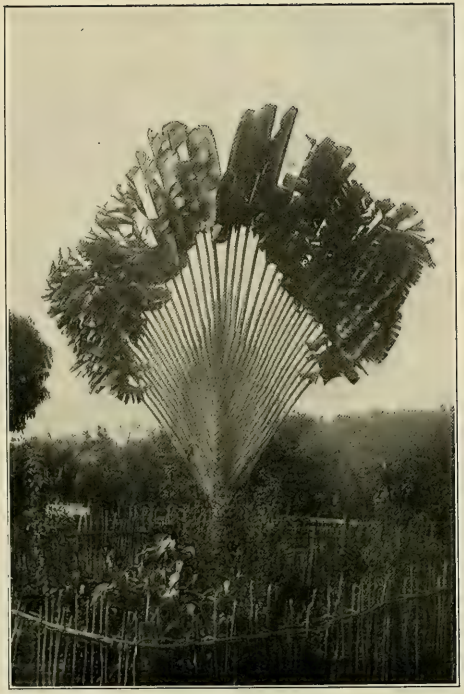
* This article is abstracted from several interesting reports recently made by Sir Harry Johnston and Minister Lyon on this negro republic, which was founded by some philanthropic Americans 90 years ago. For further information the reader is referred to the Consular Reports of the Department of Commerce and Labor and to two magnificent volumes, "Liberia," by Sir Harry Johnston, published by Dodd, Mead & Co. This work is very handsomely illustrated.

try of savannas, grassy hills, or park-land of grass, with dense forests along the stream valleys.

When I visited the coast of Liberia in 1882 and 1885, says Sir Harry Johnston, the primeval forest grew down to the sea along a great proportion of the coast; but when I visited this country in the summer of 1904, where I had noted forest growing as late as 1888, much of this big-tree woodland had been swept away to make room for plantations or even for towns. In fact, with a few exceptions, the big-tree and rubber-producing forest does not usually begin in its most marked characteristics until a journey of at least 15 miles has been made inland from the coast.

I have estimated, from the reports of the agents of the British companies and from the accounts of Liberian, British, and French explorers that out of the 45,000 square miles which may be approximately assigned as the area of the Liberian Republic at least 25,000 square miles consist of dense, uncleared forest, penetrated, it may be, by narrow native paths, but as often as not pierced by elephant-made tracks. About 3,500 square miles represent the plantations, gardens, towns, and settlements of the Americo-Liberians along the coast, and 2,000 or 3,000 square miles the clearings made by the indigenous natives in the dense forests. The remainder of the territory—about

The Foreign Consuls at Monrovia
Two Native Kings, Liberia



Travelers' Fountain

The leaves contain water which the traveler drinks

Photo by Douglas Hume

Village in Eastern Liberia

A Liberian Family and Native Children

The majority of the illustrations accompanying this article were taken by Ernest Lyon, U. S. Minister to Liberia, and were obtained by the NATIONAL GEOGRAPHIC MAGAZINE through the courtesy of Major Carson, Chief of the U. S. Bureau of Manufactures

Women of the Solah Tribe, Liberia

15,000 square miles—is grass or park-land in the possession of the Mandingo tribes, who are great cattle-breeders. From all accounts I can collect, as well as from the little I have seen myself, I do not think that much of the interior of Liberia can be described as marshy. It is, on the other hand, inclined to be hilly, and at distances of from 40 to 100 miles inland ranges of hills reach altitudes which might almost be dignified by the name of mountains.

The population of Liberia consists of about 15,000 Americo-Liberians, descendants of negroes from the United States, and 2,000,000 indigenes. So far as the outside world is concerned, the world of treaties and congresses, the country which we know as Liberia is considered to belong to and be governed by this small caste of English-speaking negroes and half-breeds of American origin. These English-speaking negroes certainly govern and administer the coast-line and a belt of more or less settled country which extends from 20 to 40 miles inland. Of late years they have been on generally friendly terms with the 2,000,000 indigenous negroes, some of whom have come very much under their influence.

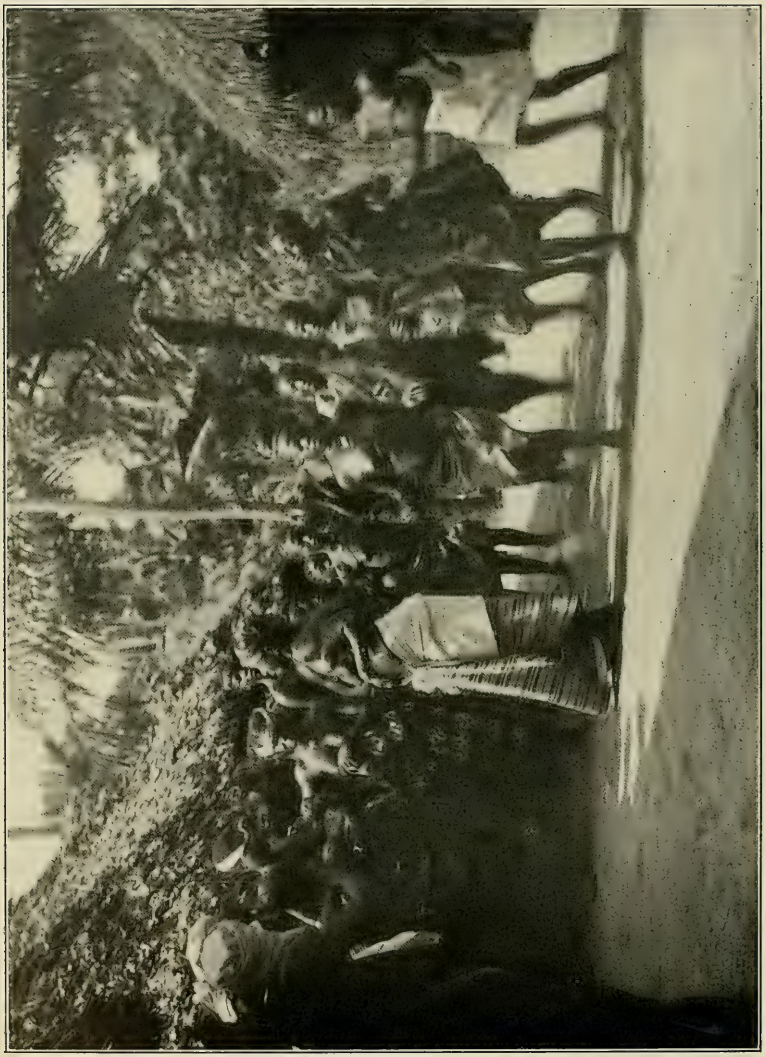
The Americo-Liberians are the survivors or the descendants of freed slaves or persons dissatisfied with their social condition in the United States of America during the early part of the nineteenth century. A considerable number of them also came from the British West Indies; but the movement which founded Liberia—the black republic on the west coast of Africa—originated with certain philanthropic societies in the United States about 1821.

The first fifty years of the history of Liberia were marked by constant struggles between the Americo-Liberian in-

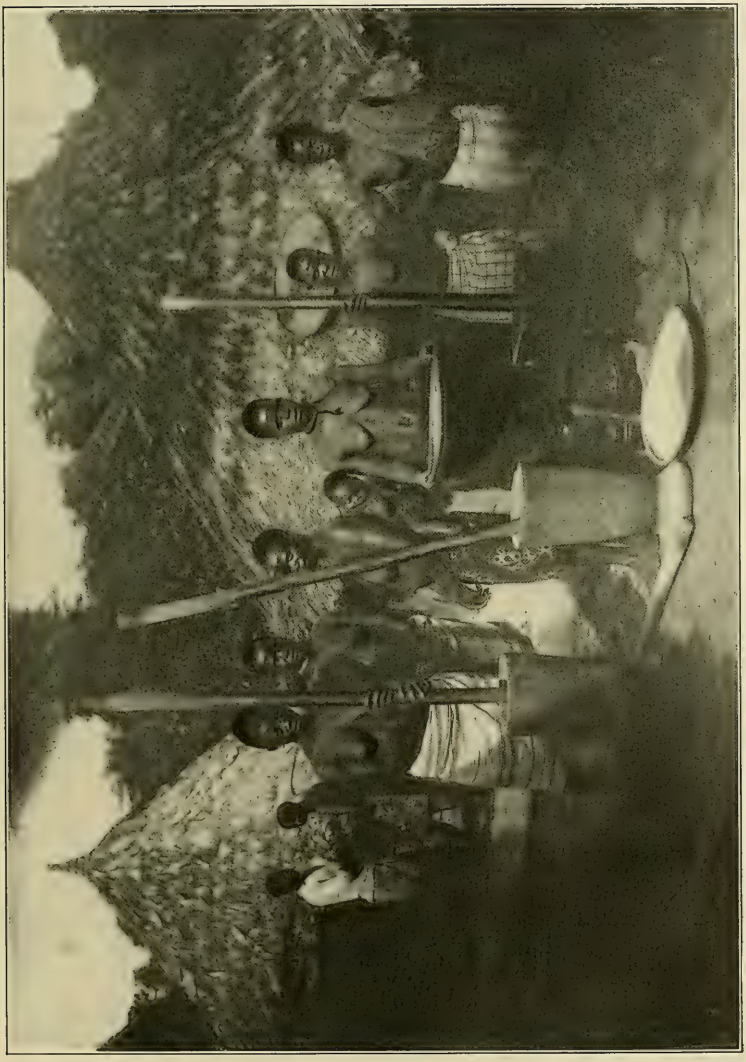
Entrance to a Native Town, Liberia

vaders and the native blacks. During the last ten years, however, there has been a marked advance in good relations between the American settlers and their native subjects, as many of them may fairly be called. The wise policy of President Barclay has greatly promoted this good feeling since 1904. He has been able to assemble at different times at the capital chiefs, or their representatives, from almost all parts of Liberia, even from the Mandingo districts, just beyond the limits of the coast belt. Curiously enough, one example of this mild rule of black by black is that the white man in Liberia is everywhere received with great friendliness, because he is not associated in the minds of the natives with anything like conquest or oppression.

How far the original experiment will succeed the next twenty years will perhaps indicate. The negroes of American origin who have settled in Liberia have not, as a general rule, been able to stand the climate very much better than Europeans, and, as a rule, they have not been able to rear very large families of children. Yet it seems to me, writes Sir Harry Johnston, as though Liberians of the new generation born in the country are beginning to take hold, but this is partly due to the increasing and, I think, very sensible practice of intermarriage with women of the fine, vigorous, indigenous races.



Dancers at a Funeral, Interior Liberia



Women Grinding Corn, Interior Liberia

Photo by Douglas Hume

Compared with other parts of West Africa, I should say that Liberia is less unhealthy for the European than Sierra Leone, the Ivory Coast, the Gold Coast, or Lagos. But it is, perhaps, too soon to judge. It is noteworthy, however, that the remarkable absence of mosquitoes should, to a great extent, coincide with a less marked prevalence of malarial fevers.

From a European point of view, perhaps the most healthy part of Liberia is the northern half, and from all accounts it would be the Mandingo plateau that Europeans would prefer for their trading or mining setlements.

The great, undoubted wealth of Liberia lies in its rubber, but the trade in this product is as yet only in its infancy. Another important article of export in the future will be timber. Piassava, which is a fiber derived from the rind of the fronds of a raphia palm, figures to some extent in the exports, which also include coffee, a little cacao, ivory, copal, palm oil, palm kernels, ginger, camwood, and annatto.

The constitution is framed after that of the United States. There are a President, Vice-President, a council of six ministers, and a Senate and a House of Representatives. The total membership of both houses is 22. Voters must be of negro blood and own real estate. The natives generally do not avail themselves of the suffrage. No foreigner can own land without the consent of the government. The capital, Monrovia (named after President Monroe), has a population of about 2,500. There is a regular army of 1,000 men. The militia number 500. The annual budget balances at about $200,000, the revenues being usually somewhat in excess of the expenditures. Customs duties furnish most of the receipts.

The American consul general to Liberia, who has recently made several journeys into the unknown interior of Liberia, writes as follows:

"The absence of railroads and of every other vehicular convenience for travel in Liberia is a serious drawback to the development and prosperity of the republic. For this reason very few Liberians venture into the interior. Except soldiers and traders, the Liberians are absolutely ignorant of the interior of their country.

"We found no roads entitled to be called such leading into the interior, either to or from native towns. They are all crooked and labyrinthine. They are made crooked to mislead the enemy, and to render his approach to a town difficult during a tribal war. The aborigines give themselves no concern about obstacles in the road. They cut down a tree and leave part of the huge branches lying across the path. They never think of removing them except when compelled to do so by a Liberian commissioner. They prefer either to climb over or to go around, and to swim a creek rather than to take the trouble to cross it by the bridge. When an old road is abandoned it is flagged by placing a branch as an obstruction at the fork of the path. The native knows what this means and takes the new road. The reason given by the native for leaving obstructions in the roads and for making them narrow and winding is not only to bewilder the tribal foe, but also to render it difficult for the Americo-Liberian to find them in their native fastnesses.

NATIVE FUNERAL

"We arrived at one village in time to witness the burial ceremonies over the remains of the king's daughter, who had died three days previously. Her death was evidently occasioned by physical exhaustion. She undertook a journey of 40 miles three days after becoming a mother. Her relatives, however, concluded that her somewhat sudden death was due to witchcraft, and the whole town accordingly set about finding the witch. The memory of the dead was honored by the customary dance, which consisted of hideous yells and physical contortions, leaving the women in a

state of exhaustion and the men in a state of frenzy. The ceremony closed with repeated volleys from firearms, to announce to the spirits on the other side the coming of the departed. Upon the grave was left a brass kettle, some of the wearing apparel of the deceased, and some articles of food.

"To discover the witch the suspected party was forced to swallow poison made from the sassy-wood bark. According to the theory, the guilty cannot live with a dose of this concoction, but upon the innocent it will have no effect. Many innocent persons have been the victims of this superstition, until recently an antidote has been discovered, which the suspects carry concealed.

"Continual tribal wars in the interior have resulted in the depopulation of whole sections and in the extermination of thousands of families. The natives are always fighting, with the result that gold, ivory, and cattle, which formerly came to the markets of Monrovia, have been diverted into other directions because of better protection to life and property.

"Women are invariably the cause of every contention. Wealth among the aborigines is based solely on the number of wives, boys, and cattle possessed. The man who has the most wives can easily be king. The abduction of one of the wives of a Pessy man and the refusal to give her up when demand is made is *casus belli*. The men of a captured town are frequently put to death in the most cruel manner, while the women and children are reduced to abject bondage. Of these the king takes the lion's share and distributes the remainder among his followers. The children are frequently sold, pawned, or given to satisfy financial demands, very often among themselves, or to members of neighboring tribes, or sometimes to Liberians, who pay the price for them, and then keep them under the apprentice system until they reach maturity, when they are given their liberty, if they do not abscond in the meantime."

ORE-BOAT UNLOADERS

IN ore transportation the cost of the boat-loading and unloading is a large part of the expense. The surface mining with steam shovels, the gravity-car system to the ore docks, combined with the automatic ore chutes for boat-loading, enables many of the ore operators in the Upper Lake regions to place the ore in the boat very quickly and at a small cost. The largest boat may now be easily loaded in one or two hours with a cargo of 5,000 to 6,000 tons and with the employment of practically no hand labor.

The expansion of the ore market has developed special ore-boats, of which the *Augustus B. Wolvrin* is a good type. The length of 560 feet, a tonnage of 8,000, and an average speed of over twelve miles per hour were extraordinary features for inland boats a few years ago, but now the members of this class are numerous and the cheapest to operate. The season tonnage for each boat of the 500-foot class is enormous. In 1906 the *W. E. Corey* moved 302,547 tons of ore in 30 trips; this is more than a whole fleet would carry 20 years ago. With boats of such an enormous cargo, the time consumed in unloading is valuable, and the problem of how to quickly and cheaply discharge the heavy and bulky cargo has received much attention from engineers and ore-handling companies.

In the early days of ore shipping it would have required 50 men working with hand-filled buckets nearly 23 hours to unload a cargo of the *Augustus B. Wolvrin*, but at the present time such a cargo is removed from the hold and placed on the cars or in the stock piles in four or five hours. The saving in expense and time during a season for some 80 boats, which is the present number of the ore fleet, is no small amount. The great unloaders have gradually

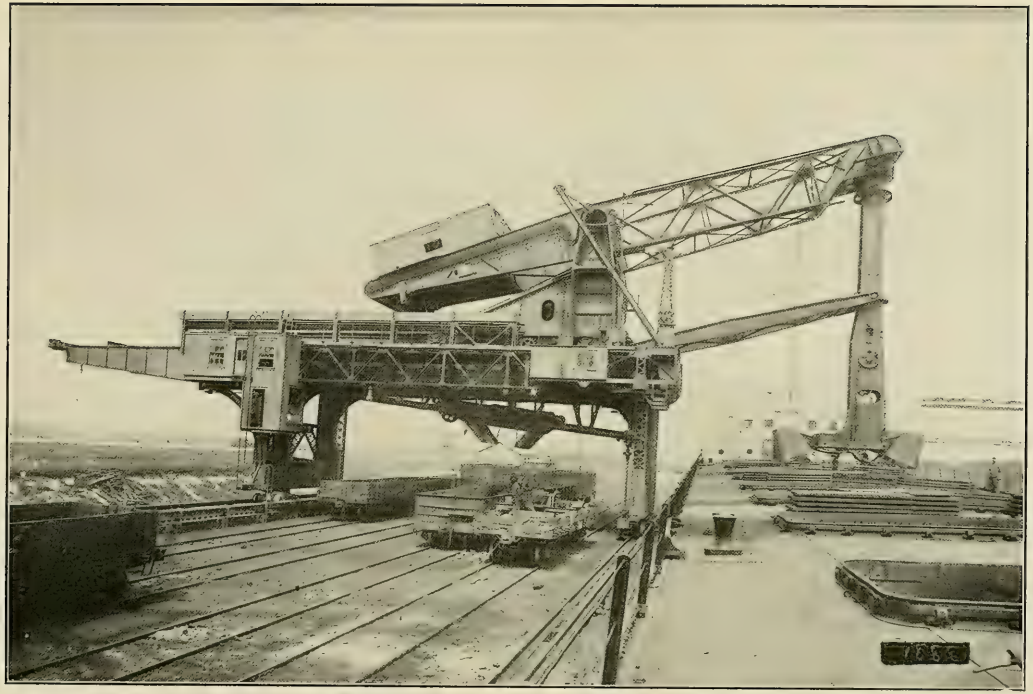


Photo from W. M. Gregory, of Cleveland, Ohio

Electric Ore Boat Unloader—the Heulett Type

The picture shows on the right the "grab bucket" about to descend in the hold of the boat. This bucket has a capacity of 10 tons and can be rotated in any direction and expanded the width of the hold. It requires the services of three men and no shovelers in the hold. A machine of this type has unloaded 681 tons of ore in one hour. These unloaders are built in series of three or four and unload a large ore boat in four or five hours

grown from the "whirlers" to the buckets on the bridge tram and into the electric "fast plants" of today.

The great modern unloaders are electrically operated and require a small amount of labor—not over three men. The first cost of the machines is high, but the time and labor saved proves their economy. The repair bill is low and the amount of dock room required to handle immense amounts of ore is small, which is a great advantage in some of the crowded ports on Lake Erie.

One of the most modern of these great machines is the Hulett 10-ton electric unloader. These machines are in operation at Conneaut, Lorain, Buffalo, and various other places, while a number are to be installed at Gary, Indiana. Each machine consists of two heavy parallel iron girders at right angles to the face of the dock and mounted on moving trucks which span four or more railroad tracks. On the two girders a carriage travels back and forth, carrying a long pivot walking beam. On the front, or the water end, of this walking beam is a vertical dependent leg, to which is attached the "grab" bucket. This leg always maintains a vertical position. The operator who controls the bucket rides in a cab on the lower end of the leg directly above the bucket. In operation the walking beam oscillates up and down, carrying the bucket down into the hold of the boat and up above the dock. The travel of the carriage back and forth on the heavy girders carries the walking beam and the bucket out over the boat and back over the dock.

The average "grab" of the bucket is nearly 10 tons, and one machine alone has taken out of a vessel's hold 681 tons of ore in one hour. Four of these great machines have removed 9,945 gross tons in four and a half hours. This is equivalent to filling a large freight car in 60 seconds or loading a train of 45 cars of 40 tons each in three-quarters of an hour. With boats of so great a tonnage and unloaders of this great capacity, it will not be long before 50 million tons of iron ore will be moved in a single season. In 1906 38 million tons was the season's record, and with the prospective new boats and unloaders, nearly 48 million tons will be moved in 1907.—W. M. GREGORY, *Cleveland, Ohio.*

FACTORS WHICH MODIFY THE CLIMATE OF VICTORIA

BY ARTHUR W. MCCURDY, OF VICTORIA, CANADA

"HOW about your climate?" "Well, it is different from that of any other place that you have ever seen," and the new arrival in Victoria at once wants to know, "How is it different, and why is it different?"

If he arrives in July or August, the warmest months of the year, he finds a mean temperature of 60° Fahrenheit and a rainfall of less than an inch per month. If he arrives in January or February, our coldest months, he finds a mean temperature of 40° and a rainfall of less than three inches per month. There may be a light fall of snow, but it soon passes away. In July and August he finds the grass brown and dry; in January and February it is green everywhere. He, too, realizes that the climate of Victoria is different from that of any other place that he has ever seen.

On the accompanying map of North America I have marked points having a mean temperature of 60° Fahrenheit for July and August and those having a mean temperature of 40° Fahrenheit for Jan-

Summer and Winter Isothermal Lines of Victoria, B. C.

uary and February, joining them by an isothermal line running from ocean to ocean.[1]

The summer isotherm of 60° after leaving Victoria enters the mainland north of Vancouver and runs inside the coast line as far north as the Yukon; then, bending southeast, it passes south of Hudson Bay, north of Quebec, and enters the Atlantic at Sydney, Nova Scotia. South of this line it is hotter than in Victoria in July and August, and north of it it is colder.

The winter isotherm of 40°, after leaving Victoria, enters the mainland at Seattle and runs inside the coast line as far south as Phœnix, Arizona; then, crossing the southern states, enters the Atlantic at Norfolk, Virginia. South of this line it is warmer than in Victoria in January and February, and north of it it is colder; so that, on the Pacific coast, in Victoria, we find the temperature of Nova Scotia in summer and that of Norfolk, Virginia, in winter. This is the more remarkable when we consider that Victoria is 150 miles farther north than Sydney and 700 miles farther north than Norfolk.

In this connection it is interesting to glance at the absolute maximum and minimum surface temperatures of the following cities of North America for 1905 as reported in the U. S. Weather Bureau Summary for that year, Chart XIV:

	Highest.	Lowest.
Victoria	84	23
Winnipeg	87	−39
Toronto	92	− 6
Montral	87	−12
Quebec	90	−19
Sydney	88	−13
Boston	94	3
New York	96	0
Washington, D. C.	95	− 2
Norfolk, Va.	95	12
Atlanta, Ga.	93	2
Jacksonville, Fla.	95	17
New Orleans	95	18
Oklahoma	98	−11
Phœnix, Arizona	116	26
St. Louis, Mo.	96	−18
Chicago	95	−18
Salt Lake City	97	− 4
Sacramento	110	28
Portland, Oregon	99	17
Seattle	90	20

It will be noticed that all other cities mentioned have both a higher and lower temperature than Victoria, with the exception of Phœnix, Arizona, and Sacramento, California, in which cases the winter minimum is not so low as at Victoria.

The following table affords a comparison of Victoria's average rain and snow fall with that of other Canadian cities for a 20-year period:[2]

	Rain.	Snow.
Victoria	30.2	17.6
Winnipeg	15.2	49.4
Montreal	30.1	123.4
Sydney, N. S.	42.6	83.6

From the above it will be seen that the average rainfall of Victoria is similar to that of Montreal, Winnepeg's being less and Sydney's greater, and that the snowfall of Victoria is one-seventh of that of Montreal, one-fifth of that of Sydney, and one-third of that of Winnipeg.

The following table gives the absolute

rain and snow fall in inches during 1905 in—[3]

	Rain.	Snow.
Victoria	23	5
Winnipeg	16	42
Montreal	25	130
Sydney, N. S.	36	125
Boston	28	45
New York	38	58
Washington, D. C.	47	41
Norfolk, Va.	42	12

With the exception of Winnipeg, the rainfall in Victoria is less than that in any other city mentioned, and Victoria's snowfall is the least of all.

To go still further into detail, the following table gives the rain and snowfall in Victoria for each month of 1905 and up to December 19, 1906:[4]

Month.	1905 Rain.	1905 Snow.	1906 Rain.	1906 Snow.
January	2.89	4.50	2.27	2.09
February	2.27		1.66	
March	1.39		0.67	T
April	0.21		0.46	
May	2.81		1.81	
June	1.06		0.65	
July	0.10		0.16	
August	1.21		0.53	
September	4.03		3.14	
October	2.81		5.60	
November	0.91		6.13	
December	2.82		2.40	0.30
Total.	22.51	4.50	25.48	3.20

These remarkable conditions are so startling that we at once look to the geographical features surrounding Victoria for the answer to the question, "Why is the climate different from that of any other place that we have ever seen?"

The accompanying map shows high mountain ranges at a distance of 40 to 100 miles from Victoria, with an opening to the Pacific between the Olympic Mountains and the mountains of Vancouver Island. In this opening lies the Strait of Juan de Fuca (20 miles wide), with low-lying lands and foothills on both sides of it. Through this gap in the mountains the prevailing southwest, west, and northwest winds, modified by the temperature of the ocean (60° F. in summer and 45° F. in winter), have free access to Victoria. They give us a temperature comparatively cool in summer and warm in winter, and carry much of their moisture beyond us, to be precipitated on the distant mountain ranges.

Outline Map Showing the Situation of Victoria, B. C.

The south winds from the Pacific in passing over the lofty Olympic Mountains drop their moisture there in the form of rain or snow and come to us as cool and dry winds.

The following table will afford comparison between the precipitation at Victoria and at stations nearer the mountain ranges upon Vancouver Island and the mainland:[5]

PRECIPITATION DURING 1905, IN INCHES

Victoria, B. C.	22.51
Tatoosh, U. S. A.	63.74
Bamfield, B. C.	53.43
Nanaimo, B. C.	42.80
New Westminster, B. C.	52.87

Southeast, east, northeast, and north are not prevailing winds and have comparatively little influence on our climate, but when we do have a northeast wind blowing from the mainland in winter or spring, as we had for a week or ten days in March of 1906, the temperature drops several degrees below freezing and the change is felt keenly. In summer the north wind, blowing over a heated land surface, is our warmest wind. There has been an occasional cold winter, with considerable snow, notably 1893, but it is unusual and has little effect on the average temperature of a number of years.

I would suggest, therefore, that among the factors which modify the climate of Victoria, giving us our mild winter, warm summer days, and cool summer nights and a minimum precipitation, are the following:

1. Our insular position.

2. The very uniform temperature of the Pacific to the west of us.

3. Prevailing westerly winds, with free access.

4. High mountain ranges situated at such a distance that but little of the precipitation caused by them extends to Victoria.

5. The Olympic Mountains, modifying the south winds and precipitating their moisture there, so that these winds reach us cool and dry.

6. Slight precipitation throughout a large portion of the year, permitting abundant sunshine during those periods.

I may add that the climate of Victoria during July and August of last year (1906) reminded me very much of that of the Nile Valley during the months of January and February. The rays of the sun were about as hot, the air as dry, the nights as cool, and there was so little rain that it was hardly noticeable.

[1] Report of the Chief of the Weather Bureau, 1897-8, p. 270-2.

[2] Canadian Meteorological Service Summary up to 1902.

[3] U. S. Weather Bureau Summary, 1905.

[4] Victoria Station, Canadian Meteorological Service, 1905-6.

[5] Canadian and U. S. Weather Bureau Summary, 1905.

"SCENES FROM EVERY LAND"

THE National Geographic Society will probably publish about September 30 a volume of from 160 to 200 pages, containing the more striking and instructive of the many pictures that have been published in the Magazine during the past several years. The Society has received many requests from members and others desiring copies of certain of our illustrations, which we have been unable to satisfy, owing to the fact that practically all of the numbers are out of print. It is planned to include in this book pictures representing every part of the world, as well as subjects of general geographic interest. The volume will consist entirely of illustrations, with from six to ten lines of explanatory text beneath each picture, and also contain a bibliography of several pages of the standard books on different parts of the world and geographic subjects, including natural history.

In order that the Society may know in advance how many copies the members may demand, it is requested that every member desiring copies will fill out the blank form printed on another page and return it as soon as possible. The price of the volume will be $1.00, and will be sent only to members subscribing for it. The volume has been prepared by Gilbert H. Grosvenor, editor of the NATIONAL GEOGRAPHIC MAGAZINE.

PHOTOGRAPH OF OIL WELL NEAR OIL CITY, PENNSYLVANIA

WHEN a well is drilled into the oil-bearing sand a charge of nitroglycerine, from 10 to 200 or more quarts, is lowered into the well and exploded, to open up the sand. This results in a better flow of the oil into the well, and as a rule materially increases the production. The accompanying photograph shows the effect, at the surface, of the discharge of 30 quarts of the explosive at a depth of 438 feet.

—*S. A. Cornelius, Oil City, Pa.*

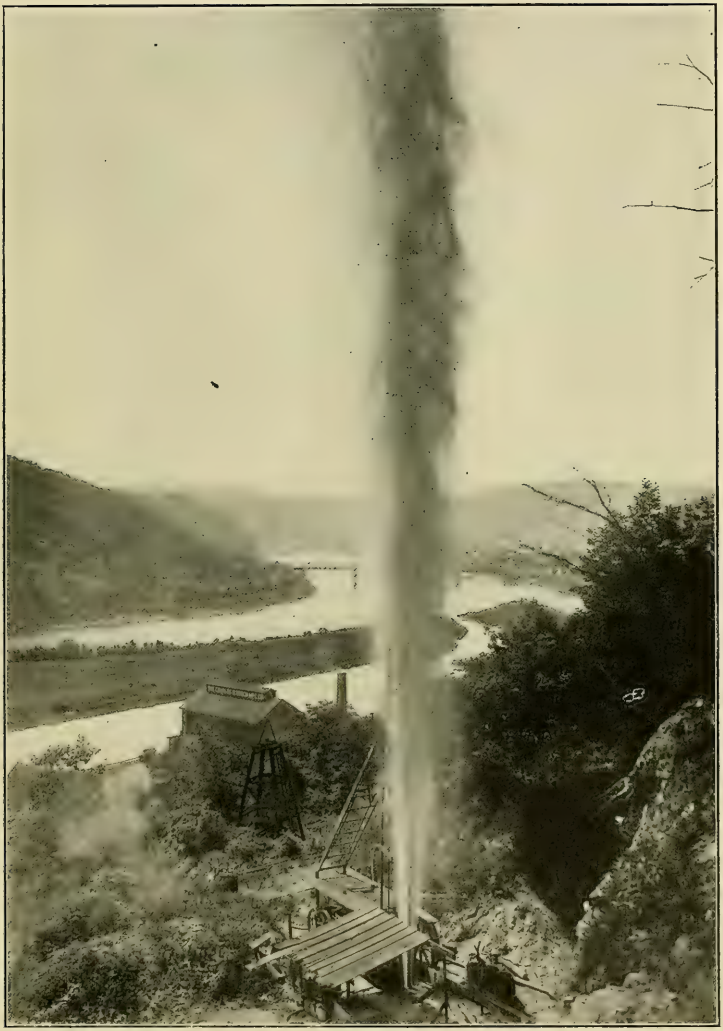
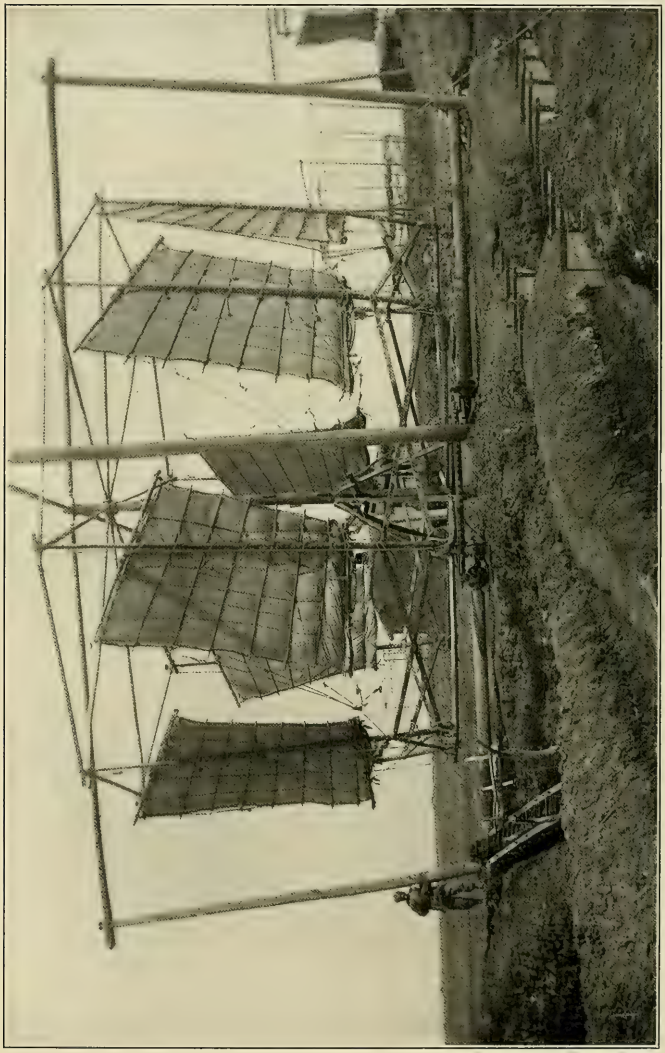


Photo from S. A. Cornelius

A Vigorous Oil Well, Oil City, Penn.



Making Salt in China

The salt sea water is pumped by these windmills into shallow ponds, where it evaporates

ECHOES OF THE SAN FRANCISCO EARTHQUAKE

By Robert E. C. Stearns, of Los Angeles

DURING the excitement incident to the San Francisco earthquake various rumors were in the air for several days, some without the slightest foundation, others exaggerations of some comparatively trifling fact, repeated from mouth to mouth, magnified and distorted with each repetition. As an illustration, it was stated that the well-known Cliff House "was thrown into the sea and not a vestige left," when in fact it was damaged to the extent of a few hundred dollars. In the following *October* we read of the *April* quake that observers in many places on the coast "noticed geysers of heated liquids ejected high out of the horizon line." It is not altogether improbable that oceanic or suboceanic disturbances caused by seismic or volcanic action may have occurred, but my efforts to trace to a definite source the statement referred to have been unsuccessful. This, like the Cliff House rumor, may be due to an overheated imagination.

The keeper of the Point Pinos Lighthouse Station, near Monterey, writes: "I did not see or hear of any disturbance of the sea at the time of the earthquake of April 18, other than that persons on board a ship entering the harbor supposed they had struck a rock."

Captain McCollough, bar pilot, who was bringing the collier *Wellington* in from the sea on the morning of April 18, is quoted as follows by a San Francisco paper: "We were off Diablo,* in about fifty fathoms of water, when the earthquake shock shook us up. The *Wellington* shivered and shook like a springless wagon on a corduroy road. The sensation at first was as if the big steamer was jumping from one gravel bed to another, and it seemed as if she would jar her insides out. As the shaking gained in intensity, it seemed as if she was blowing out boiler tubes, an explosion every second. It was a terrifying experience, and none of the uncanniness was taken off by the fact that the sea was as smooth as glass and showed not a ripple when the shaking was at its worst."

Since the earthquake the pilots have made extensive soundings on the bar and so far have found no changes in the depths. No sweeping or unusual wave occurred along the coast, at least none was mentioned in the papers at the time, though possibly there may have been some quite local movement of the sea at places along the shore of Mendocino and Humboldt counties.

A high wave, it is stated, washed out two buildings at Moss Landing, in Monterey Bay, and the shore at that point was reported to have sunk six feet. If so, it cannot properly be attributed, directly or indirectly, to oceanic disturbance, but to limited local movement, being in line with the general northwesterly and southwesterly trend, which included Hollister, Castroville, Salinas, and other near-by towns and villages in Monterey County, and southward to San Juan, in San Benito County, where the old adobe mission church of San Juan Bautista was seriously damaged.

Of the effects of the earthquake on marine life, we have barely a scrap of information. The following is not without interest: There are several parties of Japanese engaged in the Abalene (Hali-

* Point Diablo is on the northerly side of the entrance to San Francisco Bay, between Point Bonita (westward) and Lime Point (eastward), and just a trifle more than one statute mile from Fort Point, on the opposite shore. It rises sharply to 900 feet in about three-quarters of a mile; has strong current rips close around it, and is the *bête noire* to all navigators.—Davidson.

The Devil's Post Pile

Ancient lava which has spilt into columns. In the Sierras

otes) fishing along the main shore, as well as on some of the islands in the Santa Barbara Channel, working one place after another as long as each locality continues profitable and using a diving suit in pursuit of the business. It was stated at the time that a party of Japanese, with headquarters on Carmel Bay (a few miles south of Monterey Bay), left early in August last for the coast of San Luis Obispo County, with the intention of collecting abalenes near Morro Rock. In the following October it was reported that the expedition proved a failure, not because of a scarcity of abalenes, for they were found to be in great abundance, but for miles along the shore they were all dead. The ocean bed was covered with an oily, bituminous slime, or something of the kind, presumably due to the earthquake on April 18, and fatal to the shell-fish.

The discharge into the sea of poisonous matter, whatever its character, may have occurred before or since the quake of April 18, and the disturbance, whenever it occurred, may have been comparatively local and restricted to a limited range along the main shore.

The postmaster at Morro informed me that the shock of April 18 was very slight at that place—so slight that "some people were not awakened by it."

Point Pinos is about 90 miles south of the entrance of San Francisco Bay, and Morro is 100 miles south of Point Pinos.

FOR TEACHING PHYSIOGRAPHY

THE United States Geological Survey has selected a list of 100 of its atlas sheets for the purpose of illustrating a variety of physiographic forms. This has been published as a leaflet, giving under each sheet the principal physiographic form or forms which it illustrates, and with this list is a cross-reference list showing the sheets on which each topographic form is illustrated. For instance, aggrading streams are illustrated on the Maxwell (Cal.) sheet, alluvial fans on the Cucamonga (Cal.) sheet, anticlinal mountains on the Cloud Peak (Wyo.) sheet, denuded plateaus on the Corazon (N. Mex.) sheet, dissect fault blocks on the Needles (Ariz.) sheet, glaciated topography on the Becket (Mass.) sheet, lacustrine plains on the Amargosa (Nev.-Cal.) sheet, kettle moraines on the Edgely (N. Dak.) sheet, wind erosion on the Coldwater (Kans.) sheet, etc. These atlas sheets, with the aid of such a list, will prove very helpful to teachers of physiography.

This set of 100 sheets with the leaflet will be sold for $3 by the U. S. Geological Survey, Washington, D. C.

NEW TOPOGRAPHIC MAPS

The U. S. Geological Survey has recently published topographic atlas sheets of the following quadrangles:

Sheet.	State.
Birmingham Special	Alabama
Desert Well	Arizona
Bayou Sara	Louisiana
Boxelder	Montana
Kremlin	Montana
Phœnixville	Pennsylvania
Punxsutawney	Pennsylvania
Telocaset	Oregon
Vale	South Dakota
Camelsback	Arizona
Fort McDowell	Arizona
Kintla Lakes	Montana
Frisco Special	Utah
Iron Springs Special	Utah
Gilbert Peak	Utah–Wyoming
Eldorado	Illinois
New Haven	Illinois–Indiana
Dayton	Ohio
Pittsburg	Pennsylvania
Elizabeth	West Virginia
Holbrook	West Virginia
Decorah	Iowa
Chandler	Oklahoma
Evansville	Wisconsin
Casadepaga	Alaska
Solomon	Alaska
Colusa	California
Woodland	California
Louisville	Kentucky
Relay	Maryland
Ely Special	Nevada
Lake Pleasant	New York
Cowee	North Carolina–South Carolina
Bristolville	Ohio

Sheet.	State.
Greensburg	Pennsylvania
Piseco Lake	New York
Tupper Lake	New York
New Bloomfield	Pennsylvania
Thornton	West Virginia
Kirwin	Wyoming

New editions have also been printed of the following sheets:

Sheet.	State.
Patuxent	Delaware–Maryland
Burlington	Pennsylvania–New Jersey
Pisgah	North Carolina–South Carolina

The price of these atlas sheets is five cents each, or $3 a hundred. Payment should be made in cash or by postal money order, payable to the Director of the U. S. Geological Survey, at Washington, D. C.

Two Years Among New Guinea Cannibals—By A. E. Pratt. Illustrated. Pp. 350. 6 x 9 inches. Philadelphia: J. B. Lippincott Co. 1906.

This book is a fascinating narrative of a naturalist's sojourn among the aborigines of unexplored New Guinea, and reminds one very much of some of Du Chaillu's stories of exploration. The illustrations are exceptionally good. Some of the author's descriptions, however, have to be taken on faith; for instance, the story of the fishing net which is woven by spiders. According to Mr Pratt, the natives, when they want a fishing net, set up in the forest a bamboo pole, bent into an oval form. After a short while they return to find that the spiders have covered it with a web which is so tough that it makes a perfect fishing net. The book gives several illustrations of this fishing net and shows the natives dipping in the streams with them. It should be noted, however, that the illustrations are not from photographs.

The Burton Holmes Lectures. By E. Burton Holmes. 10 Vols. Pp. 4,000. 10 x 7½ inches. Illustrated. New York: McClure, Phillips & Co.

Vol. 1. Into Morocco; Fez; The Moorish Empire.
Vol. 2. Round about Paris; Paris Exposition, 1 and 2.
Vol. 3. Olympian Games; Grecian Journeys; The Wonders of Thessaly.
Vol. 4. Cities of the Barbary Coast; Oases of the Algerian Sahara; Southern Spain.
Vol. 5. Hawaiian Islands; Edge of China; Manila.
Vol. 6. Yellowstone National Park; Grand Canyon of Arizona; Moki Land.
Vol. 7. Through Europe with a Camera; Oberammergau; Cycling through Corsica.
Vol. 8. Saint Petersburg; Moscow; The Trans-Siberian Railway.
Vol. 9. Down the Amur; Peking, the Forbidden City.
Vol. 10. Seoul, Capital of Korea; Japan, the Country; Japan, the Cities.

Burton Holmes, traveler and lecturer, gives much pleasure and a fund of interesting and instructive information in his "Travelogues," a work of ten volumes, which contains his principal lectures. Three complete travelogues are published in each volume. To a great many who have not traveled extensively and to the large number who will be glad to renew their acquaintance with the out-of-the-way corners of the world this compiling of Burton Holmes' lectures will be most acceptable, for he demonstrates in this travel library his ability to impart a vivid life-like description of what he has seen in his 250,000 miles of travel fully as well with the pen as he does in his talks from the rostrum.

Realizing from a knowledge born of wide experience how much a picture conveys to the mind when a description is attempted, the author has left very little to be desired in this connection, the volumes having a total of 4,000 half-tone illustrations and 30 full-page colored plates, covering journeys through thirty different cities and countries. There are a thousand views of natural scenery—the wonderful mountains, gorges, canyons, and rivers of the world; about the same number of pictures of the great art and architectural treasures, ancient and modern; photographic reproductions of many wonderful engineering feats, with pictures of the most eminent men and women, rulers, patriots, and artists, as well as the native types of nearly every race, each taken by one who, it seems, knew just what is needful to convey the most information to the stay-at-home sightseer.

Mr Holmes as a writer has a decidedly graphic style and a genius for vivifying his narrative. The reader seems to board the train or caravan and travel along in his company, roughing it a bit now and then as well as enjoying the journey, finding and exploring curious out-of-the-way places and mingling with motley throngs in the bazar of an ancient and romantic Moorish city, or peradventure talking with a group of bearded Cossacks while en route over the Trans-Siberian Railway, as the case may be.

The travelogues are splendidly bound, printed on very good paper, and are a most valuable addition to any library. J. O. L.

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BIGHORN MOUNTAINS

By N. H. Darton

Of the United States Geological Survey

ONE of the least-known portions of the Rocky Mountain province is the high outlying range known as the Bighorn Mountains. It extends north and south across the northern-central portion of Wyoming, a rugged barrier lying between the Great Plains on the east and a wide valley, known as Bighorn Basin, on the west. Its length is about 120 miles and the width varies from 30 to 50 miles. The higher summits rise over 13,000 feet above sea-level, or about 9,000 feet higher than the adjoining plains. The mountains lie some distance from the main lines of travel, the nearest railroad being the Burlington, which passes 20 miles east of them in the vicinity of Sheridan, Wyoming. Owing to their height and northern latitude, they are extensively snow-covered, much of the snow remaining on the higher summits throughout the summer. Several small glaciers lie in the shadow of the higher peaks. During the Glacial epoch they were covered with wide-spread fields of ice, of which the present glaciers are shrunken remnants. To the geologist these mountains present many phenomena of great interest. To the sightseer and Alpine climber many of their rugged features will prove most attractive. Game is abundant and most of the streams are teeming with trout. There is no hot weather, for the summers are cool by day and cold by night.

The mountains are due to a great uplift in the earth's crust, an arch whose crest has been truncated by erosion, leaving an elevated central area of old granite, with high flanking ridges of overlying sandstones and limestones. The arch is beautifully defined by the eastward dip of the strata on the east side of the range and the westward dip on the west side, features which are well exhibited in high cliffs in many of the deep canyons which cross the front range. The central area of granite presents considerable variety of scenery. The lower portions contain numerous parks covered with grass and various herbs which afford exceptionally fine pasturage, and during the summer season these are occupied by sheep and cattle. The parks are separated by numerous rocky ridges of granite, and a wide area from 6,000 to 10,000 feet in altitude is covered with forests of pine. Much of the main divide rises above 10,000 feet and presents high, rough mountain summits with surfaces either of loose granite blocks, or steep cliffs. This district culminates in Cloud

Peak, which has an altitude of 13,165 feet. At this peak and in its vicinity there is some of the wildest Alpine scenery in America. There are numerous cliffs and pinnacles over a thousand feet high, with great variety of form and in part inaccessible. Representative views of this area are given on pages 359 to 361.

On the east side of Cloud Peak there is a cirque with vertical walls 1,100 feet high, containing in its lower portion a true glacier. This body of ice is several hundred feet thick, over a half mile in length, and it has developed a well-defined terminal moraine. A view of its top is shown on page 359. Other similar glaciers occur in deep cirques north of Cloud Peak. The topography in this area presents strongly marked characteristics of glacial origin. The higher mountain slopes are deeply trenched by profound cirques which descend into U-shaped valleys, with numerous lake basins excavated in the granite. Some of these features are shown on pages 359 and 360. Over 70 well-defined cirques are exhibited in the Cloud Peak region. Most of them are in area shown on map, page 357. Some of the notable features in this area have been described by Mr F. E. Matthes, who has also discussed their origin.* Cloud Peak can be ascended only by the spur which leads up to it from the southwest.

Numerous streams heading in the Bighorn Mountains carry large volumes of water into the adjoining plains region, where the water is extensively utilized for irrigation. These streams are fed by moderately heavy rainfall, and especially by the melting of snow, which continues throughout the summer. Water is the most important element derived from the mountains, for it sustains a population of considerable size in the adjacent lower lands. The mountain pastures are also an important feature, affording sustenance for a large number of cattle and sheep during four or five months. Not only is the feed excellent in quality but the high mountain climate is especially favorable for the animals.

The forests of the highlands have been placed in a government reserve, but before this was done they had been cut to some extent and deeply invaded by fires. The timber is mostly of moderate size and useful principally for railroad ties. In the northern portion of the range a large number of ties have been cut and floated down the canyon of Tongue River in a flume, some features of which are shown on page 362. The flume is 17 miles long and in part is carried on trestles varying in height from 6 to 90 feet. At a few points it was necessary to drive tunnels through spurs of rock. About 2,000,000 ties have been floated down this flume.

The mineral resources of the Bighorn Mountains do not appear to be particularly promising, although some of the higher areas have not yet been thoroughly prospected. A few gold and copper leads have been found, but they have given but little encouragement for further development. A moderate amount of gold-bearing gravel occurs in the northern portion of the range; it was worked to some extent by a jigging machine, but the product was not large. Very large deposits of gypsum occur in the Red beds lying along the foot of the mountains, and in the vicinity of Sheridan and Buffalo, in the adjoining plains, there are extensive deposits of lignite coals which have proven valuable.

Maps and descriptions of the geology of the Bighorn Mountains by N. H. Darton have recently been issued by the U. S. Geological Survey as folios Nos. 141 and 142.

*Glacial Sculpture of the Bighorn Mountains, Wyoming. U. S. Geological Survey, 21st Annual Report, part 2, p. 167.

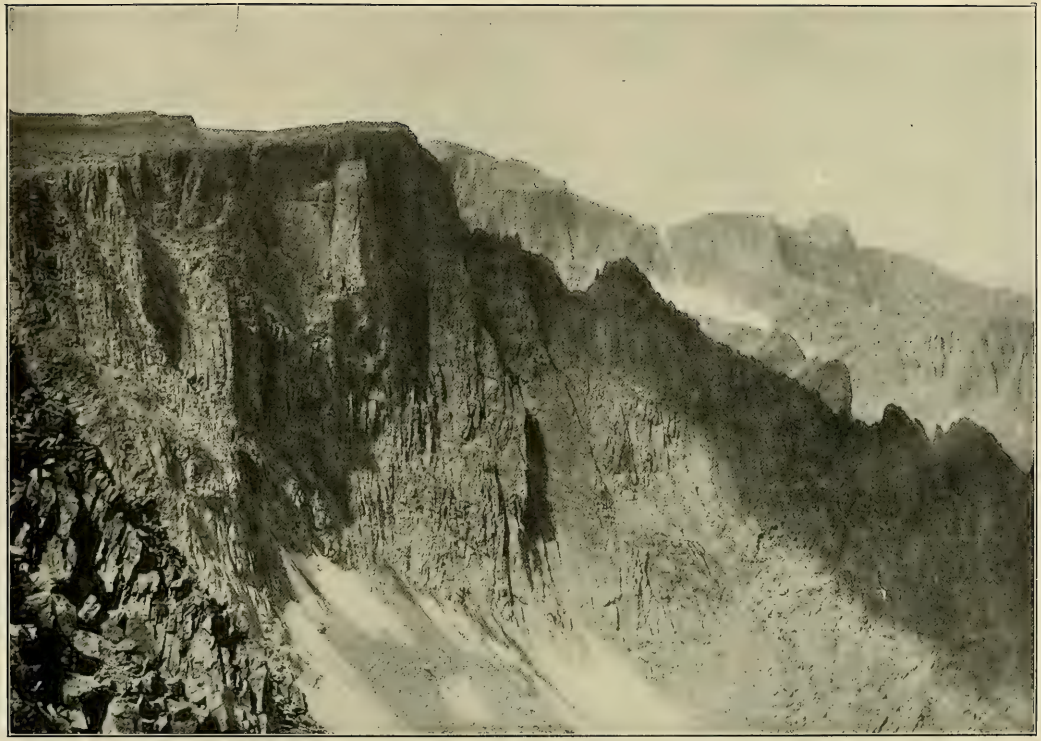
Topographic Map of the Cloud Peak Region, Summit of Bighorn Mountains, Wyoming

From Cloud Peak quadrangle, U. S. Geological Survey, by F. E. Matthes. The cirques are shown by shading; the glaciers by vertical waving lines; contour interval, 100 feet. Scale 3 miles to 1 inch. Note the many lofty peaks crowded into such a small area

Looking Northwest Across the Great Plains from the Mouth of the Bighorn Canyon, Montana

Cloud Peak from the East

The peak lies slightly to the right of the center. The cirques and U-shaped valley were carved out of the granite by former glaciers



Cloud Peak, the Culmination of Bighorn Mountains.

The peak lies slightly to the left of the center in the distance; shows deep cirques cut in the old rounded surface. The rock is granite with vertical cleavage

Crest of Bighorn Mountains a Mile North of Cloud Peak; shows Granite Broken by Frost

Looking up the Canyon of Tongue River on the East Side of Bighorn Mountains

Walls of limestone with typical castellated structure; shows flume in which railroad ties are floated from the central mountains to the plains

Canyon of Bighorn River at the North End of the Bighorn Mountains in Montana

Walls of Carboniferous limestone about 1,000 feet high

Canyon of North Fork of Powder River in Southern Portion of Bighorn Mountains
Walls of limestone and sandstone about 1,000 feet high

PICTURESQUE PARAMARIBO

The City Which was Exchanged for New York

By Harriet Chalmers Adams

PARAMARIBO, the quaint capital of Surinam, the city which was exchanged for New York! After a Dutch, a French, and an English occupancy, Surinam (which we English-speaking people call "Dutch Guiana") came again into the possession of the Netherlands through the Treaty of Breda (1667), in which England received title to New Amsterdam, the present site of Manhattan.

The traveler approaches Surinam from the sea. We had left behind the hilly coast of French Guiana, and the morning after sailing from Cayenne entered a wide, muddy channel bordered by marshy lowlands. This was the River Surinam, the great highway of the country.

Our first impression of this transported Holland was of a land with a unique individuality. Ascending the river, we looked in vain on the forest-lined shores for the crude thatched cabins typical of the wilderness in other South America countries. Instead we saw, in well-defined clearings, pretentious farm-houses with gable roofs and dormer windows.

After fourteen miles of river travel came the news, "Paramaribo is in sight!" and we rushed to the bow to see, on the right bank, a collection of these peaked-roofed, many-windowed houses, streets lined with fine old trees, and government buildings facing a grassy common of irregular shape.

Upon landing we were even more impressed with the quaint architecture and with the people who thronged the streets. Paramaribo may well be termed "the city where many types meet."

There are staid merchants from the mother country and gay officers of Queen Wilhelmina's army; there are colonial Dutchmen and their families, who have never been out of Surinam. In great numbers are the blacks, descendants of the slaves.

The costume worn by the negress is unusual, consisting of a short blouse with a deep collar and a long full skirt, which is doubled over a cord at the waist, falling about the hips in an immense puff; this gives the appearance of great weight and awkwardness. A brightly colored kerchief, so tied as to produce a broad effect, drapes the head. In "Taki-Taki," the patois of the blacks, this is termed the "Kottomissi" costume.

"Taki-Taki" is a weird tongue, a mixture of English, Dutch, Spanish, Portuguese, and French; it has probably a touch of an African dialect as well. In it may be traced the imprint of many peoples upon the slaves. It has become "the universal language" of the colony, Dutch being the official tongue.

Three oriental types mingle with the negroes, the Javanese from Hollands' colony in the East Indies, the Chinese, and the Hindus. The latter come from the near-by British colony, where they have served their allotted time as indentured coolies.

The Javanese are small and slight, resembling the Japanese. Both men and women wear scant garments and are bare-legged. Short jackets, often pea-green in shade, adorn the women, and cloths, arranged about the hips, fall to their knees. The costume of the men is like that of the Hindus—white blouses and loin-cloths and huge white turbans.

Gorgeously bedecked are the Hindu women, draped in brightly colored silk scarfs, their plump arms laden with heavy silver bracelets; their ears, noses, fingers, and ankles decorated with gold and silver ornaments. This display repre-

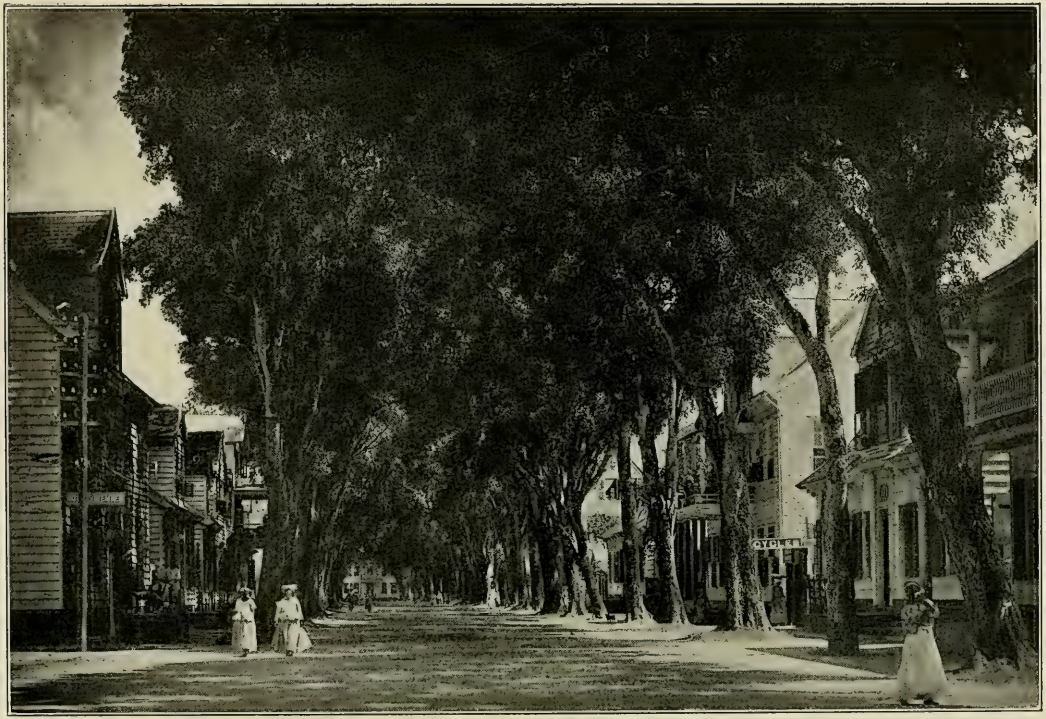


Photo from Mrs Harriet Chalmers Adams

A Street Lined with Mahogany Trees in Paramaribo

The trees are reputed to be worth about $50,000

Photo from Mrs Harriet Chalmers Adams

Market Scene—Paramaribo

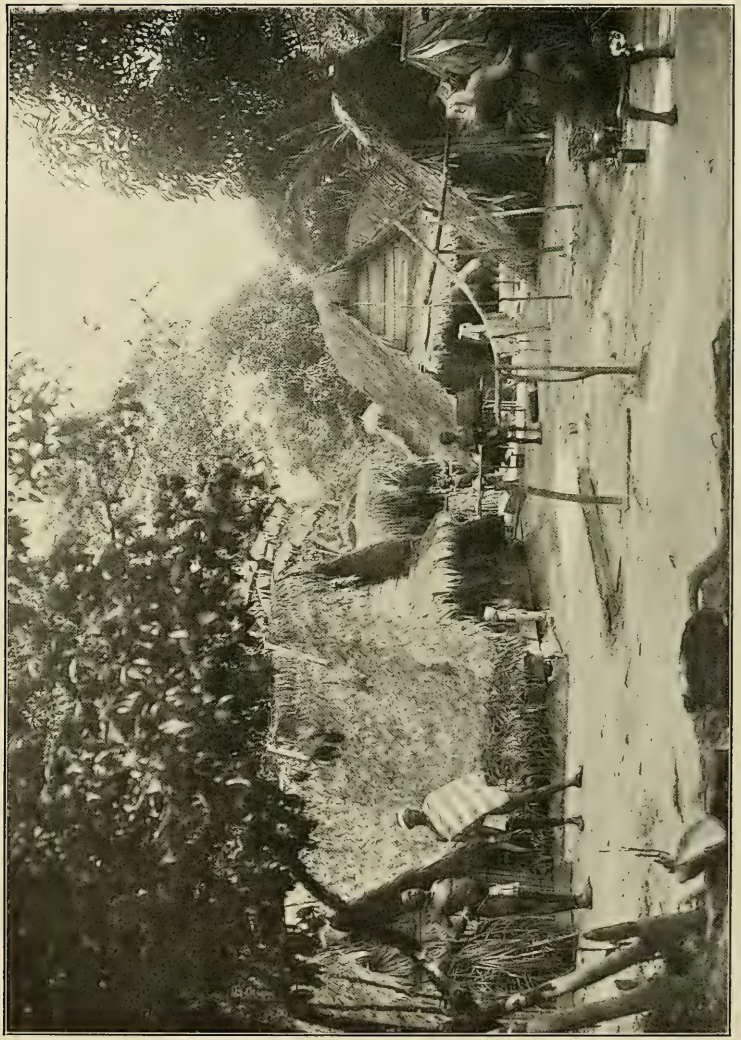


Photo from Mrs Harriet Chalmers Adams

Bush Negroes, Dutch Guianas

Photo from Mrs Harriet Chalmers Adams

Bush Negroes, Wife and Children—Wilds of Surinam

They are the descendents of escaped slaves

Photo from Mrs Harriet Chalmers Adams

A Belle of Surinam

Photo from Mrs Harriet Chalmers Adams

Two Colored Girls of Surinam (Dutch Guiana)

Photo from Mrs Harriet Chalmers Adams

Native Indian Girls in the Bush.

The ones with curly hair show a strain of negro blood

sents the family wealth, and many of the rings and bracelets are of home manufacture.

Now and then, in a crowd of negroes, "Kottomissis," and Orientals, all jabbering "Taki-Taki," we saw a new type of African, unlike any other in the New World. This is the Bosch, or Bush, negro, who inhabits the wilds of Dutch and French Guiana. Occasionally he comes into town to trade.

In the seventeenth century the owners of plantations in Surinam sent their slaves into the forest for a time in order to avoid payment of taxes. Many of the blacks did not return to the estates, escaping to the depths of the forest, where they have ever since maintained themselves as free men. Their habits are not unlike those of the negroes in the wilds of Africa. They are virtually unclothed, have thatched shelters, and worship the ceiba, or cotton tree.

On the streets of Paramaribo we met these men, wearing only an apology for garments, and at times, in the diversified group, saw another forest type, the rightful lord of the country—the native Indian. He had come from his home far up the river to sell baskets, hammocks, and featherwork of his own manufacture.

To study the life of the oriental, one need go only to the coolie villages in the suburbs of the city; but to know the ways of the Bosch negro and the aborigine one must travel by canoe and trail to the "Bush."

Throughout the Guianas the habita-

tions are on the shores of the rivers, and the great forest-covered country beyond is termed the "Bush." In recent years it has become the field for gold-hunters. Surinam's sugar and cacao plantations can be reached by the one railroad of the country, forty miles in length, which in the future may connect the capital with the gold fields. Since the fall in the price of sugar, the country has not been self-supporting and is maintained by Holland through the prosperity of the big sister colony, Java.

Paramaribo is built on a shell reef, and many of its streets are well paved with a mixture of shell and earth. "Heerenstraat" is the city's most attractive avenue—broad and lined with ancient mahogany trees. The story is current that the sum of forty thousand dollars has been offered for these trees, but, being the colony's pride, they are in no grave danger of being sacrificed.

The hotel which we patronized was a clean, airy house, with wide verandas. The rooms were large and finished in natural wood, the table simple but wholesome. Unfortunately, however, this hostelry overlooks the market (pleasantly situated near the city's main sewer), and our room was just above a group of cabins occupied by laundresses, who kept up a steady stream of "Taki-Taki" all day long and late into the night. It seemed to us to be the most "actively conversational language" we had ever heard.

The market-place is a narrow platform shaded by a peaked roof, and the women sit on the floor beside their wares, resembling huge mushrooms in their stiffly starched "Kottomissi" costumes.

A picturesque and an interesting city is Paramaribo, with its glistening white streets, its majestic trees, and its old-fashioned buildings; its blending of many types—European, Asiatic, and creole! Surinam does not seem to us to form a part of South America. We associate it rather with the West Indies, to which it is allied by ties of history, race, and commerce.

AN IMPRESSION OF THE GUIANA WILDERNESS*

By Professor Angelo Heilprin

Of Yale University and Editor of Lippincott's "Gazetteer"

IN assigning to me "The Guianas" as a topic in the course of lectures on Latin America, I assume that the Board of Directors has taken for granted a special knowledge on my part of this most interesting section of the earth's surface. In fact, however, the knowledge that I possess, so far as it relates to a personal contact, is derived from a single brief journey made to this region in the spring of last year, undertaken almost wholly for the purpose of satisfying an old-time desire to see the great South American forest, illumined by the writings of Humboldt, Schomburgk, and other great masters, before it was despoiled by man. The conditions of nature in this region as they exist today differ but little from those of a hundred years ago. It is true the force of civilization has invaded the wilderness in spots; has marked out villages here and there; but the aspects of this progress lie mainly toward the ocean front, and the traveler has but to travel a short distance into the interior to find the wild and untrammeled nature which so delighted Waterton.

In the vast area that stretches between

* Abstracted from an address delivered before the National Geographic Society, February 8, 1907.

Photo from Mrs Harriet Chalmers Adams

Indians in a "Dugout," near the Mouth of the Orinoco

the mouths of the Orinoco and the Amazon is a part of that great forest which in magnitude and the exuberance of its vegetal forms finds no equal on the surface of the earth. It is through this wilderness that large and turbulent waters, brown of color and almost unknown except to the geographer, discharge their volume in masses as great as those of the main rivers of Europe—the Rhine, the Danube, the Volga. It is in this region, too, that patches of lofty plateau, seven and eight thousand feet or more in elevation, speak in eloquent language of changes in relief which the slow processes of denudation and land-movement have brought about.

There are three Guianas, namely, Dutch Guiana, French Guiana, and British Guiana. Their characteristics are so fundamentally alike that I will ask you to bear with me if in my general description, as well as in my characterization of impressions, I refer to British Guiana alone.

Almost the only change that one notices today in the interior of British Guiana, compared to what the country was fifty or seventy-five years ago, is that a certain amount of navigation has been imposed upon some of its major streams. Small steam craft, offering as much comfort as one ordinarily wants, and admirably adapted to surveying the landscape, navigate the lower waters for a distance of 60 to 100 miles of the Essequibo, Demerara, Berbice, and Corentyn; and beyond, where rapids break the continuity of the first reaches of smooth water, their service is continued by minor craft, some of them of an almost shiftless character, which lure the traveler or prospector for an almost equal distance farther. In the entire region that is desig-

nated British Guiana there is practically not a single roadway penetrating into the interior. Such roads as exist are those that follow the contour of the ocean, being implanted upon the hard, dry sand which lines the ocean for a long distance, and the few miles following irrigation and drainage canals, which strike out to abandoned cane plantations and to the few sugar mills that continue with a fair amount of success to wage the strife against the competitive industry of beet-sugar.

The first free impression of nature that the traveler obtains in British Guiana is associated with the immediate surroundings of Georgetown, the capital. In the great expanse of meadow land, the savannas of the northern part of the country, which stretch back a distance of from two to twenty and thirty miles, a large stretch of country is below sea-level, and is held in position away from the overflow of the ocean by the construction of sea-walls and sea-dams.

Photo by Angelo Heilprin

A Giant Three-toed Sloth

PROFUSION OF HERONS, ALLIGATORS, ANACONDAS AND ALL KINDS OF LIFE

The profusion of life that is met with—the free life of birds, quadrupeds, and reptiles—is most astonishing. While I had expected naturally to see much of this, yet I was wholly unprepared for the reality, and it was a marvel to note how little heed the animals take of the presence of man. The meadows literally swarmed with the wild fowl of the country; the great white heron, the ibis, egret, and spurwing were out in thousands, caring little as to whether man was near or far. You walk along the short roads that have been constructed along the canals and find almost every bush—practically every tree and every bush that line the road—alive with the hawk and the eagle and other birds of prey, who sit and plume themselves, seemingly regardless of the passing strangers, who may approach them to within five or six feet or less.

The waters immediately about us, although not everywhere, teem with alligators, who likewise appear to bear but little grudge against man. At times

they come out into the roadway, and for a while at least take possession in defiance of man.

I chanced to be an invited guest at the residence of a prominent physician in Buxton, a small hamlet situated a few miles eastward of Georgetown, and had there a rare opportunity of picking up odd and striking facts pertaining to the natural history of the region. On approaching my host's house, which was the type of the regularly constructed "summer-house" of the people of that country, I noted nailed over the veranda the large skin of the water "kamudi," which I was told was the general name in use for the water-boa, or anaconda. The length of the specimen was twenty feet seven inches. I naturally assumed that it was a trophy extending back for a number of years, and that the monster had been killed in the backwoods of the country; but, on inquiry, I was told that the reptile had been killed in close proximity to the house, and that only during the past summer.

On a first afternoon's walk we stumbled upon a specimen of the gray fox, and likewise upon a crab-dog, which the colored people were following and stoning in the manner of the "coon"-hunt in our own southern states. On the following morning a gray fox, its feet closely tied together, was deposited on the steps of our house, awaiting a possible purchaser.

In the course of a side railroad excursion, while waiting for a passing train, I noted in the rear of the post-raised station a single dark object, which for a while baffled analysis, but soon resolved itself into a large-sized manatee. It had come in from the ocean in one of the drainage canals and was cropping the herbage in the puddle that surrounded the depot.

In the course of a later journey up the Essequibo River, close to the banks, we passed a little troop of capybaras, perhaps six or eight in number, which had come out of the forest to take advantage of a protecting sand-spit. A few minutes later a large black jaguar emerged from the forest, and, wholly unmindful of our presence, leisurely walked down the spit in pursuit. We had a splendid opportunity of watching this singularly graceful and lithe animal in a walk of some 150 to 200 yards.

This is the kind of life that still presents itself to the naturalist. I am, perhaps, a little more insistent on this point than seems necessary, but it is for the purpose of correcting the impression that the wild life of the tropics is everywhere becoming a thing of the past. From all that I could learn in Guiana, I should say that there was little change in this life since the day of the publication of Waterton's inimitable "Wanderings of a Naturalist."

THE GREAT PRIMEVAL FOREST

The great primeval forest, which is perhaps represented on a more impressive scale than anywhere else in South America, is the same that was described by the brothers Schomburgk in 1848 and 1850. We traveled up the middle course of the Essequibo River for seventy miles without finding a solitary clearing, not a single break in all the forest, except where tributary streams flowed into our own. On both banks of this chocolate-brown stream, at a distance of seventy miles from its mouth, where the width of the stream is still from one to two miles, or four to five times the normal width of the Mississippi River, the great curtain of the primeval forest hangs virtually untouched by man. If I were asked to state briefly the distinguishing characteristics of this forest, I should find it difficult to frame a reply, or to give to it proper perspective in a comparison with the forest elsewhere. The great South American primeval forest is impressive, is imposing, but at the same time it is forbidding. With the great walls of vegetation rising to a height of 175 and 200 feet, with the crown of the forest carried at this enormous height above the spectator, and with innumerable creepers and trailers binding the whole into an

Photo from Mrs Harriet Chalmers Adams

On the Banks of the Essequibo, British Guiana

almost impenetrable maze, the eye that is on the exterior has difficulty in finding points of rest or repose. But little sunlight penetrates into the recesses of the interior, and what there is of it comes out in scattered flecks of brilliantly reflected light and not as sunlit areas.

In its botanical relations, the forest does not look particularly tropical, if by tropical we mean an aspect of vegetation which is dominated by types that one habitually associates with the lower climes and whose general physiognomy differs from the types of temperate regions. It is true that the eye fails to note the familiar forms of the oak, the maple, beech, birch, or poplar; but the general contour of tropical foliage, especially where it appears lost in mass, is not very different from that of these trees or of trees that in one form or another make up the bulk of the north woods. Except where clumps of palms stand out in particular relief, the trees of the South American forest have, apart from exceeding luxuriance and magnitude of dimensions, so nearly the characteristics in foliage of the trees of our own region that the traveler could easily misinterpret the landscape of which they formed a part. Even where palms are present, they generally lose their crowns in the

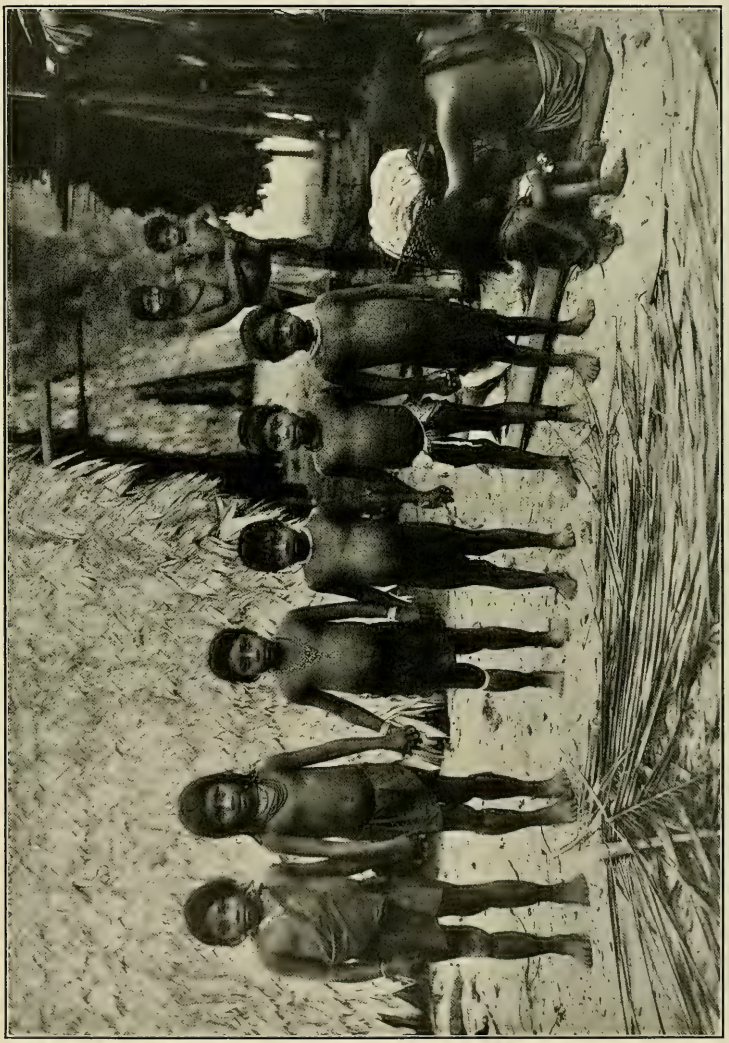
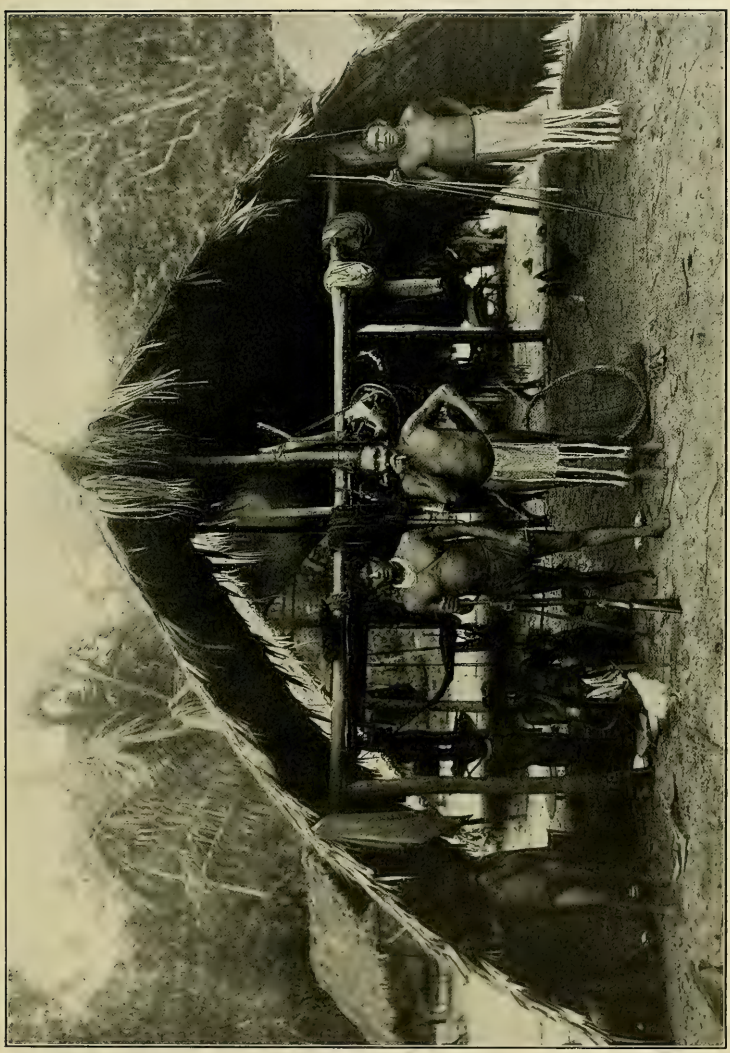


Photo from Mrs Harriet Chalmers Adams

Indian Children in the Wilds of Guiana



An Indian Family of the Guianas

Photo from Mrs Harriet Chalmers Adams

Photo from Mrs Harriet Chalmers Adams

In the Great South American Forest

wall of vegetation that rises above them and no longer appear as dominating or physiognomic types in the landscape; they are hardly more than sporadic components of the vegetation.

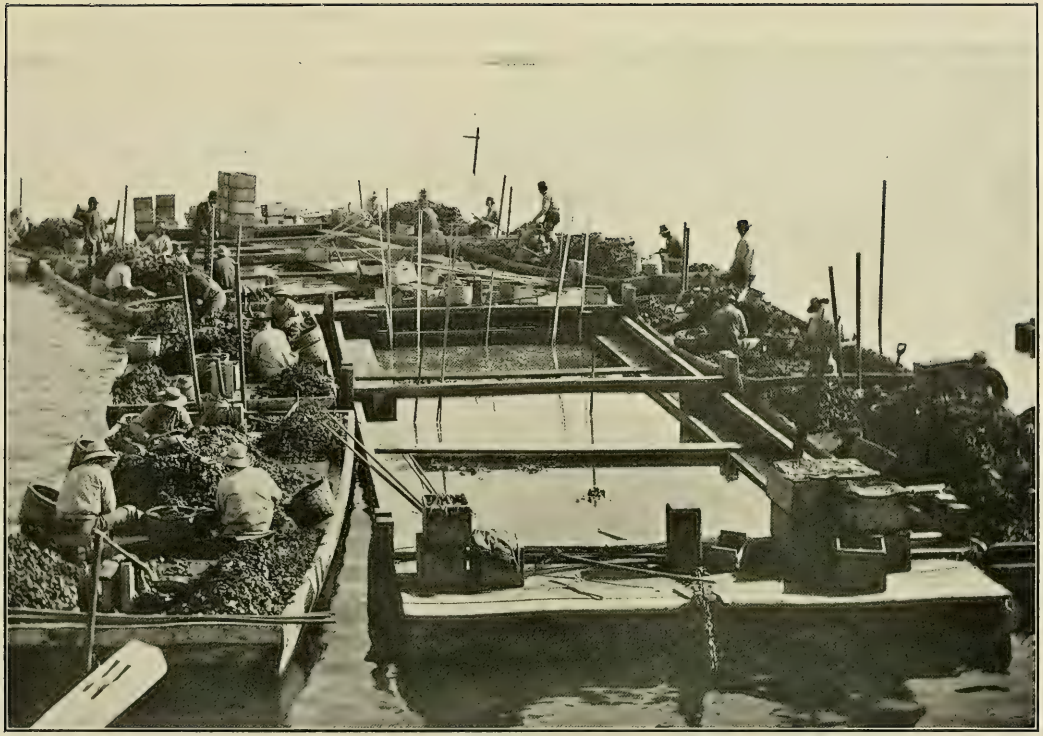
It is only when we penetrate into the interior of this great forest, when we study the individual elements that compose it, that we begin to be impressed with distinctive characteristics. One can truly say that almost every tree of the South American primeval forest is a botanical garden of its own. Rising up in supreme magnificence, the trunk hardly sending out a branch before it has attained a height of 125 or 150 feet, and completely overgrown with creeping and climbing plants, aroids and orchids, it is as wholly different from the trees of the northern woods as it well can be. The tendency to spreading umbrella-like crowns likewise differentiates the forest components of the south, as do also the giant buttressed roots which distinguish so many of the species.

Alfred Russell Wallace, who has enjoyed unusual advantages for the study of the general characteristics of tropical vegetation, has emphasized as one of the marked features of the tropical forest the absence of flowers. He says, indeed, that one may travel for weeks at a time along the streams of the Amazon region without once realizing those aspects of floral development which, whether by profusion of growth or by size and color, impress the landscape of temperate regions. This picture does not seem to apply to the forest of the river banks of the Guianas, and its inaccuracy has been pointed out by that acute student of nature Mr M. Turn. The streamers of purple, red, and white which hang down over the forest curtain easily recall in profusion and wealth of color the flowers of the north—the field daisy, clover, and buttercup. Indeed, it would be difficult to recall in forests of the north, even as rare instances, that display of flowers which so frequently repeats itself here.

The extraordinary passifloras, the cassias, the rhexias, and innumerable orchids are a glory unto themselves. It is only on or close to the banks of the rivers that the forest in any way approaches impenetrability. Farther inward, where the more majestic portion of the forest is reached, there is comparatively little undergrowth, and the giant foresters stand up unbroken, like the supporting pillars the interior of a church..

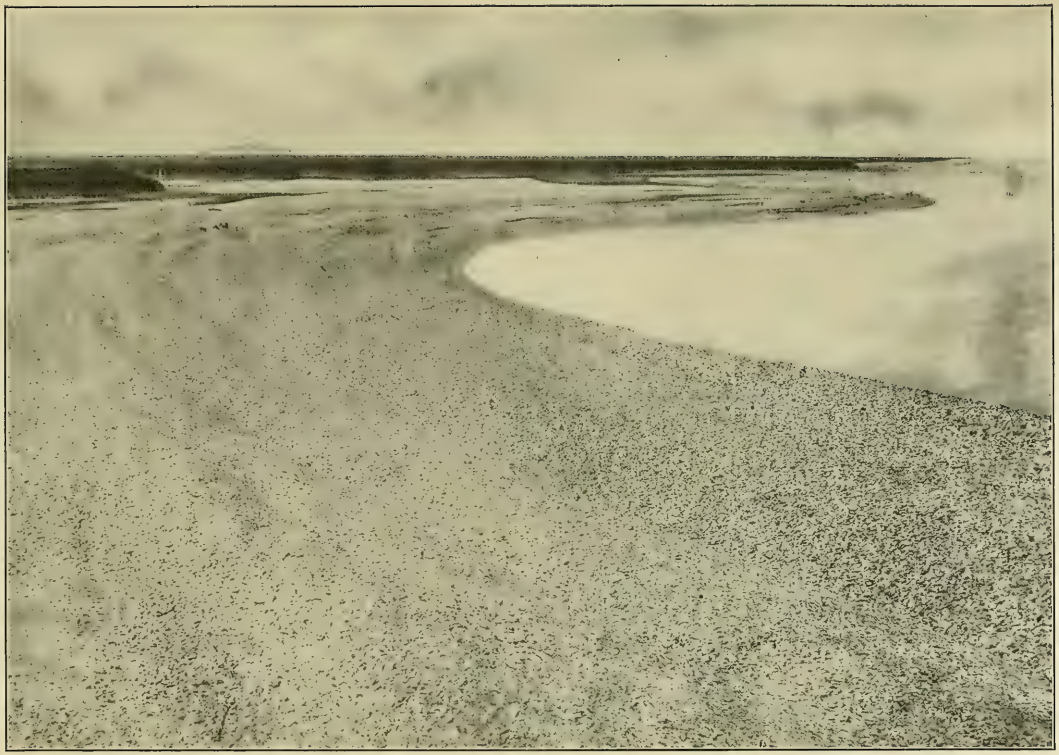
The animal life of the forest surprised me by its numbers. It was not the silent wilderness, the nature that was hushed to sound, that the writings of some naturalists had led me to believe that it was. From the early hours of morning until sunfall, the forest rings with the cries of the Toucan and parrot, while the metallic tones of the chatterers and buzz-saw beetle swing out in majestic cadence a parting of the ways. At night-time this side of the forest is silent; but other strange sounds—the fitful roar of the howling monkey, the croak of the Surinam toad—give ample evidence that the land is still of the living. It was this way, at least, that I found the forest in April. There were but few insect pests to annoy one, and that assumedly omnipresent torment of the southern wilds, the mosquito, was virtually entirely absent.

This brief picture is, without doubt, not the true picture of the entire Guiana wilderness, but it is an impression which a few weeks' journey of wholesome pleasure has brought to me.



Part of the Oyster Crop in San Francisco Bay — Photo from U. S. Bureau of Fisheries

The eastern oyster was transplanted some years ago and now yields an annual output worth $600,000 (see page 394)



Beach on Western Side of San Francisco Bay — Photo from U. S. Bureau of Fisheries

Composed entirely of native oysters which, at this place, extend in an unbroken line for 12 miles. These oysters are seldom eaten
(see page 394)

Preparing Caviar on the Columbia River

Photo from U. S. Bureau of Fisheries

Notice the exposed roe of the sturgeon in the center of the picture

OUR FISH IMMIGRANTS

By Hugh M. Smith

Deputy U. S. Commissioner of Fisheries

ONE of the most important, extensive, and interesting lines of utilitarian work conducted by the federal government is the transplanting of native aquatic animals into waters in which they are not indigenous, and the introduction of fishes of foreign countries into the United States. Most people are familiar with the economically important results of acclimatizing foreign species or varieties of mammals and birds in our country, and every one can recall some of the many valuable vegetables, fruits, and other plant products that are immigrants; but comparatively few people are aware of the systematic and varied measures that have been taken by the government for increasing and enriching the supply of food and game fishes of every section of the country, and still fewer realize the extent to which the commercial fisherman, the sportsman, the youthful angler, the farmer, and the public in general are indebted to the National Bureau of Fisheries and the state fish commissions for providing many kinds of useful creatures that did not originally inhabit given waters.

OBJECTS OF ACCLIMATIZATION

When we contemplate our wonderful aquatic resources—unsurpassed as a whole for variety, abundance, and excellence—the question naturally arises as to the necessity for planting non-indigenous species in any of our waters. The occasion for such efforts comes from a number of conditions which have been duly considered by the authorities; among these are:

(1) The depletion of the indigenous fishes of given waters and the inability to secure the reëstablishment of those species, either by restrictive measures or by artificial propagation, owing to changed or changing physical or biological conditions.

(2) The possibility of enriching the fish fauna of a given water by introducing more useful species than already exist therein or by affording a greater variety of fishes for food and sport.

(3) The existence of physical or other conditions more inimical or unfavorable to the native fishes than to other fishes that might be introduced.

(4) The possibility of relieving the drain on native species by providing new objects for the pursuit of the angler and the commercial fisherman.

(5) The desirability of reducing the abundance or securing the extermination of noxious fishes and other water animals by planting fishes which will prey thereon.

Features of aquatic acclimatization which may be noted especially are the interchange of products between the eastern and western parts of the country, the introduction of eastern fishes into new waters of the east, and the importation into the United States of fishes from foreign countries. This work has affected not only the lake and pond fishes, but also the migratory river fishes of both seaboards and some strictly salt-water forms; and since, for practical purposes, the term "fish" has generally been construed as meaning every kind of animal taken from the water for profit or pleasure, the operations have involved many creatures that the biologist would not class as fish.

SOME INSTANCES OF UNWISE INTRODUCTIONS

The seemingly benign and beneficent work of transplanting water animals is not wholly free from possibly harmful results, analogous to those that have attended the transplanting of land animals, of which the rabbit in Australia, the mongoose in Jamaica, and the English sparrow and Norway rat in America are well-known examples. Even when such transplanting is done advisedly and with circumspection, there is a possibility of untoward results that will offset any benefits that may accrue. Injury may arise from a general disturbance of the "balance of nature" by the introduction of new factors into given waters, or from the supplanting of one kind of animal by another less desirable. The ignorance or indiscretion of private persons who undertake to introduce new creatures into waters in which they are interested may produce most disastrous effects, while in a few instances carelessness or a mere accident has had a far-reaching effect. Great care has been exercised by the Federal Fishery Bureau in making plants of non-indigenous fishes, and injurious results chargeable to it have been extremely rare; but eternal vigilance is necessary, and many applicants for fish become disgruntled because they are not permitted to have their own way. Fine trout streams may be quickly ruined through the planting therein of bass, or lakes stocked with some defenseless valuable food-fish may be depleted by the thoughtless planting of some comparatively unimportant rapacious species.

Some of the states have been quick to recognize the necessity for restricting the planting of non-native fishes, and have enacted laws prohibiting the introduction of any fish not approved by the state authorities. One of the most persistent demands on the Bureau of Fisheries is for black bass to stock western waters that already contain an abundance of trout or salmon. Such practice is little short of criminal, and in all such cases where there is reason to fear that valuable trout waters may be ruined the Bureau takes the precaution to defer to the judgment of the state fishery officers.

One of the most unfortunate instances of the destruction of one species by another is that of the grayling, a superb food and game fish of which only three colonies had survived some cosmic cataclysm and had become established in regions as isolated as Alaska, Montana, and Michigan. In the last-named state trout were recklessly planted in some of the few streams inhabited by the grayling, with the result that the grayling has been completely exterminated therein. It is only in Tennyson's "Brook" that

> here and there a lusty trout
> And here and there a grayling

live in harmony together.

With the transplanting of eastern oysters on the western seaboard, there has been introduced one of the small boring mollusks or drills which is very injurious to oysters on the Atlantic coast and is maintaining its reputation in California. It has become very abundant, and several years ago was reported to be destroying annually oysters to the value of $30,000.

Another unfortunate case of accidental or unintentional acclimatization is that of the alewife in Lake Ontario. By means of canals, the alewife found its way from the Delaware or Hudson River into Lake Ontario, and there soon became excessively abundant; but lack of food or the changed habitat resulted in a stunted race of no economic value, and furthermore this fish is subject to a periodical epidemic which kills millions each season; these pile up on the shores or pollute the water, and prove such a menace to health that the local authorities are often put to considerable expense in removing them. It is possible, however, that by serving as food for other fish the alewives in Lake Ontario are saved from the stigma of being unmitigated nuisances.

Another untoward aspect of the acclimatizing of native fishes is the annoyance or confusion which may come to

future students of geographical distribution and variation. A phase of this work is seen in the long-continued and wholesale planting of shad from the Potomac, Susquehanna, and Delaware rivers in practically every other stream on the Atlantic coast, with the result that whatever local varieties or races of shad may once have existed are now no longer recognizable. Some years ago I undertook to verify the oft-repeated contention of old fishermen, that shad from different parts of the coast exhibit peculiarities of form and color; and, as a matter of fact, this was to be expected, from the views now held regarding the migration of the species—the schools that enter a given region, such as Chesapeake Bay or the Gulf of Maine, not being made up of individuals hatched in numerous or widely separated hydrographic basins, but constituting a definite contingent whose immediate and remote ancestors had frequented the same waters. In this inquiry many thousands of specimens from the Saint Johns to the Kennebec were critically examined, but with only negative results, so far as the existence of local races was concerned, and the conclusion was reached that the promiscuous artificial mixing of shad in the different rivers had led to the final obliteration of whatever differences had originally existed.

Fortunately the artificial extension of the range of our interior and coastwise fishes is not so serious a matter now as it would have been earlier, for the systematic examination of our lakes and streams under federal and state auspices has gone so far that the natural geographical range of nearly all our fishes has been accurately determined.

EASTERN FISH IN NEW EASTERN WATERS

In all the waters of the eastern half of the country the range of all the important native food and game fishes has been extended artificially. Very extensive work has been done with the black basses, the crappies, the rock bass, the brook trout, the land-locked salmon, the lake trout, and the more desirable catfishes, while a number of very excellent fishes with restricted original distribution have been judiciously scattered and thus brought to the notice of thousands of people who would otherwise never have known them.

The debt that sportsmen owe to the fishery service of the United States and the several states for their acclimatization work is heavy and increasing yearly, and the obligation is shared indirectly, but not the less actually, by hotel-keepers, boatmen, merchants, land-owners, and others. There could be cited numerous concrete examples of the varied benefits that have come to communities through the stocking of local waters with non-indigenous species. In some cases the improvement in the fishing has so increased the influx of people that land about the waters has increased several hundred per cent in value in a few years.

SALMON IN HUDSON AND DELAWARE RIVERS

A controversy was waged for many years over the question whether the Hudson was originally a salmon stream. The chief basis for the belief that the Atlantic salmon frequented that river in former days was the mention of salmon in several early Dutch documents and in various entries in the log of the *Halfmoon* during Henry Hudson's memorable visit to the river in 1609. No salmon were actually caught by Hudson's crew, and there is every reason to believe that the fish they saw and the fish referred to in the records of New Holland were some other species. Certain it is that there is no evidence of the existence of salmon in the Hudson, except possibly as mere stragglers, at any time during the eighteenth century or in the nineteenth century, until about 1890, when the national government, coöperating with the State of New York, attempted to establish the salmon in this noble river—a feat that would have meant a great deal to anglers, net fishermen, and the general public.

It is a matter of no little interest that as early as 1771 the colony of New York

had under consideration the question of transplanting salmon from Lake Ontario or from neighboring rivers to the Hudson, and in that year, at the instance of the corporation of Albany, a law was enacted prohibiting for a term of years the taking of such introduced fish. This project, however, does not appear to have been followed up, and it remained for the present generation to give it a trial. The states bordering on the Delaware were also solicitous for the introduction of salmon into that stream, which had never contained salmon, and the test was made therein about the same time.

Of the many salmon streams that New England once had, the only one that has survived is the Penobscot, and this has been maintained solely by artificial means, for natural spawning has for some years practically been suspended. It was at the well-known salmon hatchery located on Craig Brook, a tributary of the Penobscot, that the young fish for stocking the Hudson and Delaware were hatched and reared. Rather liberal plants were made for several years, beginning in 1890, and in the fifth year after the first deposits mature fish began to be caught in the nets of the shad fishermen. It is a matter of record that over 300 salmon weighing 10 to 38 pounds were caught illegally in the Hudson in 1895, and fully 300 were taken in the Delaware in the same year and sold. This gratifying outcome was widely heralded as establishing the feasibility of inducing a permanent supply in these rivers; but, unfortunately, when the planting of young fish was discontinued the run of adult fish in due time declined, and today those waters are as free from salmon as they ever were. These efforts, however, were not altogether useless, since they showed (1) that the young fish ran to sea, remained in the vicinity of the rivers until mature, and then were impelled by the spawning instinct to return to the same rivers, and (2) that the streams proved unfavorable for natural reproduction, for there is little or no evidence that effective spawning took place.

Whether the making of large plants for a long series of years would eventually establish the salmon in these two rivers and in others formerly inhabited by the fish is perhaps an open question, but to my mind is very doubtful. The physical conditions in most of our northern streams are each year becoming more unsuitable for such species because of obstructions, pollutions, clearing of forests at their headwaters, etc.; and if it is possible to establish any kinds of salmon therein the greatest chance for success lies with some of the less fastidious western species.

STOCKING THE POTOMAC WITH NEW FISHES

As an example of what may be done for a large stream in the way of beneficent acclimatization, the case of the Potomac River may be cited. The commercial fisherman, the professional fly-caster, and the casual angler all have cause to render profound thanks for what has here been accomplished in their interest.

The most valuable non-indigenous fishes now inhabiting the Potomac are the small-mouth and large-mouth black basses. Ichthyologists and fish culturists are well aware that these most excellent food and game species are not native to this river, but their introduction occurred so long ago that the general public has lost sight of the interesting facts connected therewith. It was in 1854, shortly after the completion of the Baltimore and Ohio Railroad, that a lot of small-mouth black bass from the Ohio River were brought east in the water tank of a locomotive engine and liberated in the basin of the Chesapeake and Ohio Canal at Cumberland. Having free access to the Potomac, the fish soon found their way to various parts of the river, and inside of ten years literally swarmed in all the tributaries from Mount Vernon to the headwaters. At the present time the species affords much sport from Washington to Harpers Ferry and beyond, but is not common below the capital. The

introduction of the large-mouth black bass into the Potomac basin was accomplished by the Bureau of Fisheries in 1889, the first plants being made in the Shenandoah and later in the vicinity of Washington. By 1896 the fish had become remarkably abundant, and now it is taken in large numbers by net fishermen and anglers in all the lower fresh-water reaches of the river.

The strawberry bass and the crappy were established in the Potomac by the Bureau of Fisheries in 1894, and both are now common in a long stretch of the stream from Alexandria upward. They are excellent food and game fishes, and many are caught by anglers and many are sold in the Washington markets. Other members of the bass family that have been colonized in the Potomac are the rock bass, the warmouth, and the bluegill.

As a result of plants of fry between Washington and the Great Falls, the wall-eyed pike or pike perch, the largest and most valuable member of the perch family, has been acclimatized and for five or six years has been attracting attention. It is not yet very numerous, but apparently is becoming more so each season and in time should prove a valuable addition to the supply of fishes caught for market and for sport.

Not the least important of the additions to the Potomac fauna are two catfishes from the Mississippi basin. One of them, the spotted or blue cat, is probably the best of the tribe, inhabitating cold, running water, having dainty feeding habits, possessed of game qualities scarcely inferior to those of the bass, and being excellent food. Small plants of adults and yearlings were made at Quantico, Virginia, and Woodmont and Hagerstown, Maryland, in 1889, 1891, and 1892; and since 1899 the fish have been taken in increasing numbers each year, especially between Washington and Little Falls, many of them weighing 10 to 20 pounds. Recently there have appeared in the river considerable numbers of another species, the great fork-tailed cat, of the introduction of which there was no record; so it is evident that the young were mixed with the spotted cats and were overlooked when the plants were made. This fish reaches a weight of more than 100 pounds in its native waters, and examples taken from the Potomac by line fishermen have weighed upward of 30 pounds.

CONTRIBUTIONS OF THE EAST TO THE WEST

Probably the most noteworthy results attending the introduction of aquatic animals into new regions have been seen in the Pacific states, and represent contributions from the eastern seaboard. Among the eastern fresh-water fishes that have been firmly established and more or less widely colonized in the Rocky Mountains or in regions beyond the mountains are the large-mouth black bass, the crappy, the yellow perch, the pike, several catfishes, various sun-fishes, the land-locked salmon, and the brook trout. The sportsmen of all the western states are now afforded excellent black-bass and brook-trout fishing. Migratory eastern river fishes that have been permanently introduced into the Pacific streams are the striped bass and the shad, and the economic results therefrom are without parallel in the entire history of migratory fishes. Chief among the marine invertebrates of the Atlantic coast that are now found on the west coast are the oyster and the soft-shell clam.

A few years ago a fishery official of an eastern state made the prediction that the brook trout is doomed and will be unknown, as a wild species, a few generations hence. This gloomy prognostication is perhaps justified if restricted to certain streams of New England and New York, where pollution, obstructions, and deforestation have already destroyed many fine waters and are ruining others; but in the eastern lakes the brook trout is more than holding its own, while the west is prepared to afford unsurpassed trout fishing for the entire country. The attention of anglers should be directed to Colorado, which has known the brook trout for only a few years, but is now

more thoroughly stocked than any other state. So successful has been the work of acclimatization in Colorado that the government now draws on that state for most of its supply of brook-trout eggs, which are obtained chiefly from wild fish in mountain streams and lakes; and it is in accord with the eternal fitness of things that the progeny of Colorado brook trout should be used for replenishing the very eastern waters from which the original stock was taken for introduction into Colorado.

It is generally conceded that the Yellowstone National Park affords some of the very best trout fishing to be had anywhere in the world. The thousands of anglers who have dropped their lines in the limpid waters of that wonderland and the thousands and millions who are yet to enjoy the delights of fly-fishing and trolling amid those most inspiring scenes have been and will be indebted to the paternal solicitude of the federal government, which has not only stocked lakes and streams of the park which had from time immemorial been entirely destitute of fish life, but each season, in a quiet but effective way, takes steps to maintain and increase the supply of trouts. Furthermore, a commendable policy has been adopted and adhered to by which different kinds of trouts are kept in separate waters, so that the park gives opportunity for the most varied and at the same time the most specialized trout fishing. Thus, in one river basin the black-spotted trout exists to the exclusion of other species, in another the rainbow, in another the brook, in another the lake, and in others several European trouts.

SHAD ON PACIFIC COAST

The colonizing of the shad on the Pacific coast was one of the greatest achievements in fish acclimatization. Aside from the important economic results, the experiment was noteworthy because of certain changes that have occurred in the habits of the species, and because the feat of transporting shad fry across the continent at that early day was justly regarded as remarkable, and had a marked influence on the development of fish transportation, which has now attained such perfection. With the experiment were associated two of the pioneer fish culturists of America, whose names and fame are known the world over—Seth Green and Livingston Stone.

It was in 1871 that the California Fish Commission made arrangements with Seth Green to take to California a lot of young shad from the Hudson River. He started with 12,000 newly hatched fish in four 8-gallon milk cans, and by indefatigable efforts succeeded in carrying his delicate wards to the Sacramento River and planting 10,000 of them at a point 275 miles above Sacramento. In 1873 Mr Livingston Stone, of the U. S. Fish Commission, carried to the Sacramento a second lot of shad, 35,000 in number, also from the Hudson River. In 1876, 1877, 1878, and 1880 further plants, aggregating 574,000, were made in the same river. In 1885 and 1886 deposits aggregating 910,000 were made in the Columbia River. No shad fry were introduced into the Sacramento after 1880 or into the Columbia after 1886.

That the shad found the waters of the Pacific states entirely congenial was quickly demonstrated. In April, 1873, a shad 1 year 9 months and 20 days old and weighing 3 pounds was caught in the harbor of San Francisco, and the lucky fisherman was paid a reward of $50 offered by the California commissioners for the first shad. In a short time many more were taken in the vicinity of San Francisco; by 1879 they had become numerous; by 1883 the supply in some places was reported as almost unlimited, and a few years later the shad were regarded as one of the most abundant food fishes of California, and the price to fishermen and consumers was less than in any other state.

Shad were first taken in the Columbia in 1876 or 1877, so it is evident that an offshoot from the California colony soon migrated northward and had already established itself when the new emigrants

arrived from the east, 8 or 9 years later. By 1881 the fish seems to have become distributed along the coast of Washington, and in 1882 reached Puget Sound. It was 9 years later, however, when the first pioneer was recorded from Fraser River, and the same year there was a report of shad in Stikine River, southeast Alaska. In 1904 a fine roe shad caught at Kasilof, on Cook Inlet, was the first known arrival in that remote region. To the southward the fish is found as far as Los Angeles County, and the present range of the species thus extends along about 4,000 miles of coast. It is not improbable that the migrations of the shad will extend still farther. Twenty years ago, when the fish was found along only 2,000 miles of coast—from the Golden Gate to Puget Sound—the national fish commissioner at that time suggested that the species would follow the track of the Asiatic current and eventually reach the coast of Asia and establish itself in some of the great rivers. This prognostication has not yet been realized.

The two great centers of the shad's abundance are the Sacramento basin and the lower Columbia River, and it has been asserted that in either of these waters more shad could be taken than in any other water-course in the country. The catch affords an inadequate criterion of the shad's abundance, for fishermen and dealers report that it would be easily possible, should the demand warrant it, to treble or quadruple the present yield, as most of the fish are now taken incidentally in apparatus set primarily for other species.

Viewed from the purely business standpoint, the transplanting of shad to the Pacific coast has been a remarkably good investment. As near as I can ascertain, the total cost of the experiment was under $4,000, and the results in California, Oregon, and Washington have been approximately as follows:

Annual catch at present time...	1,500,000 lbs.
Aggregate catch to end of 1906..	13,250,000 lbs.
First value of aggregate catch.....	$302,000

Were it not that the shad has to compete with a great variety and abundance of other excellent fish, for which there is a strong predilection born of habit and sentiment, this species would be in the front rank of west coast fishes in the popular estimation. Notwithstanding its excellence, abundance, and cheapness, it is not very popular in the west, but there are indications that it is becoming more generally appreciated.

It is not an altogether unreasonable suggestion that a few generations hence eastern people will be compelled to obtain their shad from Pacific waters, for the very destructive fishing methods now pursued in the eastern rivers are having a most disastrous effect on the perpetuation of the species, and in some streams the death knell of the shad has already been sounded. Rivers on which the general government has been conducting shad-hatching operations for 30 years have recently been deprived of practically their entire run of spawning fish, and the hatcheries have been rendered useless. The cultivation of shad on a small scale was begun in the Columbia River in 1906.

STRIPED BASS ON PACIFIC COAST

The history of the introduction of the striped bass on the western seaboard is quite similar to that of the shad, and the results have been equally striking. In 1879 the Federal Fishery Bureau planted in an arm of San Francisco Bay about 135 striped bass, mostly 1½ to 3 inches long, from the Navesink River, in New Jersey. A second plant of 300 small fish from the Shrewsbury River, New Jersey, was made near the same place in 1882. There were no other transhipments of this species; and in contemplating the outcome of this experiment after the expiration of a quarter of a century, well may we exclaim, "How great a fishery a little plant hath made!"

The striped bass found the waters of San Francisco Bay and its tributaries as congenial as did the shad, and has shown an almost uninterrupted increase in abun-

dance to the present time. A number of years ago the California striped-bass catch exceeded that of any other state, while now it surpasses that of any group of states along the eastern seaboard.

From the San Francisco region the species has gradually spread up and down the coast, and its range may eventually equal that of the shad. Up to 1896 the fish had not been reported outside of California, but several years ago it began to run in some of the coast rivers of Oregon, and in the fall of 1906 half a dozen fine specimens were caught in traps at the mouth of the Columbia River, the first recorded from that stream.

The striped bass, far removed from its ancestral home, has maintained the enviable reputation it enjoys in the east, and is freely recognized by its new friends as one of the best food and game fishes of the Pacific coast. It has become a prime favorite with anglers, and I should not be surprised if a vote would show that it is now the leading game fish of California. As every one knows, the striped bass always commands a high price in the east, and is often to be ranked as a luxury; but its abundance in California waters has so reduced the cost to consumers that even the frugal Chinese can afford to eat it, and a comparison made some years ago showed that throughout the year the San Francisco dealers were underselling the New York dealers by many points. The economic importance of the introduction of the striped bass on the Pacific coast may be judged from the following figures:

Entire cost of transplanting	less than.. $1,000
Annual catch in recent years	1,750,000 lbs.
Value of same to fishermen	$105,000
Aggregate catch to end of 1906	14,960,000 lbs.
Total value to end of 1906	$812,000

CONTRIBUTIONS OF THE WEST TO THE EAST

The fishes which the western states have given to the remainder of the country belong to the trout and salmon family, and up to the present represent only two species that have been actually acclimatized in eastern waters; these are the rainbow trout and steelhead trout. Experiments are now in progress with several other trouts, and, more important, systematic efforts are being made to establish several of the Pacific salmons in New England waters. If this should be accomplished, the first debt that the west now owes the east for courtesies rendered and benefits conferred will largely be liquidated.

The foremost contribution of the west to the east is the rainbow trout. This fish, which is one of the finest American salmonoids and has long been the subject of fish-cultural operations, is native to the streams of the Sierra Nevada and the Coast ranges. Beauty, large size, rapid growth, hardiness, food value, and game qualities combine to make this a general favorite. By anglers it is usually rated next to the brook trout, although many consider it fully as gamy as the latter fish.

The transplanting of this species in regions east of the Rocky Mountains has been a conspicuous success and has proved a decided boon to many communities. Its acclimatization by the general government was first undertaken in 1880, although it is probable that some years prior thereto small plants had been made in new waters by state commissions or private persons. The rainbow trout has now been introduced into nearly every state and territory, and has become one of the most generally known fishes in every part of the country. In Michigan, Missouri, Arkansas, Nebraska, Colorado, Nevada, and throughout the Alleghany Mountain region, its transplanting has been followed by especially noteworthy results. Its position in the streams and lakes of the eastern states is that of a substitute and not a rival of the brook trout. It is well adapted for the stocking of waters formerly inhabited by the brook trout, in which the latter no longer thrives on account of changed physical conditions; it is also suited to warmer, deeper, and more sluggish waters than the brook trout finds congenial.

The rainbow trout is subject to much

variation, and numerous varieties or species are now recognized. The form that has been most extensively cultivated and disseminated came from McCloud River, in California, the site of the first salmon-hatching work in the west. This stream is fed by melting snows on Mount Shasta, and its picturesqueness is worthy of the beautiful fish it has given to the outside world. The station in the east at which the species has been most largely propagated is at Wytheville, in the Alleghany Mountains of southwest Virginia.

Ichthyologists have not fully decided whether the steelhead trout of the Pacific Coast rivers is a distinct species or only a rainbow trout that has the habits of the salmons. In the west it is classed with the salmons because of its size and migrations; but in the east it has readily taken on the characteristics of a strictly fresh-water species, and has become a competitor of the land-locked salmon. The first successful attempt to bring this excellent food and game fish within reach of the people east of the Rocky Mountains was in 1896, when the planting of fry in rivers at the western end of Lake Superior was begun. In the following year many fine specimens were caught in those streams, and in 1898 fishermen setting nets in deep water for lake trout began to take large steelheads along the American and Canadian shores of the lake, and in the same year fly-fishermen of Duluth caught in French and Sucker rivers not less than 2,000, the largest 28 inches long. The species is now firmly established in Lake Superior and will doubtless in time spread to others of the Great Lakes. The Bureau of Fisheries has recently begun the hatching of eggs from wild fish taken in streams near Duluth. Each season eggs of the steelhead are sent from points on the Pacific coast to stations in the east where the hatching in completed, and the species has obtained a firm hold in a number of New England lakes and has proved an acceptable addition to the fish supply.

A group of trouts of the rainbow series inhabits a circumscribed area in the high Sierra Mountains of southern California in the vicinity of Mount Whitney. All of them are extremely handsome, and two of them, known as golden trouts, only recently discovered by the Bureau of Fisheries, may fairly be regarded as among the most dainty and beautiful of the entire trout tribe. One has been named for that charming writer of western sketches, Stewart Edward White; the other enjoys the distinction of bearing the name of that mighty hunter and fisherman, Theodore Roosevelt. It lives in a snow-fed creek on the southern slope of the Sierras, and its habitat is so restricted and the number of individuals is relatively so few that grave fears have been felt that what is easily possible might quickly come to pass—the complete extermination of the species. The Federal Fishery Bureau has therefore sent to the scene a party which has brought out on the backs of mules, over an extremely difficult, almost perpendicular, trail of 20 miles, a brood stock of golden trout, and has transferred them to various suitable stations at which they will be cultivated. If all goes well, it will be only a few years before anglers in all parts of the country are casting flies for the golden trout, whose gameness equals its beauty.

PACIFIC SALMON FOR EASTERN STREAMS

The most momentous experiments in fish transplanting now in progress are addressed to the Pacific salmons, and perhaps the greatest boon the west is destined to confer on the east is the replenishing of the New England streams with salmon. The physical conditions in the streams that formerly were inhabited by the Atlantic salmon forbid the possibility of ever reëstablishing that species, but it may be that some of the Pacific salmons will find those waters congenial. Trials in the east began with the Chinook salmon—the largest and best of the tribe—and there have been a few encouraging successes reported from the Saint Lawrence basin and from Maine; but it would appear that this species re-

quires conditions that it does not find. Experiments are now in progress with the silver salmon and the humpback salmon—species of little value for canning, but exceedingly good when eaten fresh. Each fall for a number of years several million eggs have been shipped across the continent to be incubated in the Maine and other eastern hatcheries and the resulting young planted in all suitable waters along the coast. These fish require smaller streams for spawning purposes than the Chinook or the Atlantic salmon, and the Bureau is quite hopeful that they will take kindly to many of the coastwise streams of New England, and it is not improbable that some mature specimens may be found in the Maine rivers this season.

ATLANTIC OYSTERS ON PACIFIC COAST

The native oyster of the Pacific coast is a small species, with a strong coppery flavor that persists under all conditions of growth and even after cooking. To a person who is acquainted with the luscious oyster of the east coast, the western species is an unsatisfactory substitute, and there are many people on the Pacific coast whose local pride and persistent effort have not enabled them to overcome their repugnance to it. It was therefore a great boon when, at a comparatively early date, the Atlantic oyster was introduced and took its proper place as the best molluskan food of the Pacific seaboard.

The origin of a very extensive California industry dependent on the eastern oyster is said to have been due to a mere expedient to avoid loss. About 1869 a San Francisco fish firm ordered three carloads of large eastern oysters. This was the first shipment of the kind, and the market was overstocked, so the consignees were obliged to dump a part of the cargo in San Francisco Bay. The oysters thrived and subsequently yielded a handsome profit; and this enforced experiment has led to an important trade, and to the inauguration of a system of oyster culture that has remained unique.

A number of oyster-planting companies are now engaged in bringing one- and two-year old oysters from New York and vicinity and planting them in various parts of San Francisco Bay, where large areas are now devoted to the cultivation of this mollusk. The oysters grow rapidly, retain their native flavor, and are marketed at very remunerative prices after being on the beds for two and three years. The supply is chiefly kept up by annual replenishment from the east, the oysters being brought in refrigerator cars holding 150 to 200 barrels; some seasons the shipments have amounted to 100 or 125 carloads.

The planting grounds are surrounded by substantial stockades, which serve the twofold purpose of keeping out poachers and preventing the destruction of the oysters by sting-rays, large schools of which visit the bay at certain times each year. The plantations are overlooked by watch-houses on piles, which are headquarters of the men employed in the working of the beds. As required, the oysters are tonged into large scows and transferred to floats, in which they are retained while being culled. Oysters large enough for sale are placed in boxes or sacks and shipped to market, while the small oysters and the shells are replanted.

California enjoyed a monopoly of this industry for many years. In 1894 the Bureau of Fisheries made a successful plant of 80 barrels of eastern oysters in Willapa Bay, Washington, and demonstrated to the people of the northwest coast the possibility of growing to marketable size in their waters oysters brought from the Atlantic. Private companies have now undertaken the business in Willapa Bay, Puget Sound, and several other points in Washington and in Yaquina River in Oregon, and the outlook is quite favorable for the development of a remunerative trade.

The one drawback to the complete success of this business is the necessity for depending on the east for keeping up the supply. This is particularly true of Oregon and Washington, where the

water is too cold to permit the eggs of the transplanted oysters to develop. In San Francisco Bay, owing to the warmer water, a small but apparently increasing proportion of the output represents oysters that have been produced locally.

How large a factor in the Pacific states fisheries the Atlantic oyster has become may be appreciated when it is stated that it is exceeded in value by only the salmons, and that the annual output now reaches $600,000 to $700,000.

The soft-shell clam, accidentally carried across the continent with the oyster, has thrived well; has been retransplanted from California to Oregon and Washington, and is now yielding the fishermen an annual income of about $30,000.

UNITED STATES FISHES IN OUR INSULAR POSSESSIONS

It seems to be pretty definitely understood now that the American Constitution does not necessarily follow the flag. In this respect it differs from American fishes, of which quite a number of species have already become established in our insular possessions and are enjoying all the privileges accorded them at home, while various others will doubtless in time prove valuable additions to the fauna of Porto Rico, Hawaii, and the Philippines.

While the fresh waters of the Hawaiian Islands are too small and unstable to permit very extensive results from acclimatization, experiments have been conducted with quite a number of species. A single attempt to establish the large-mouth black bass has been unsuccessful, but there is reason to believe that this fish may do well in some of the ponds. Bullheads from California have been planted in the same waters, and should easily be established if desired. Frogs, introduced as early as 1879, have become abundant on several of the islands and are now reaching the Honolulu market. Besides their value as food, they have proved beneficial to cattle-growers by consuming large numbers of fluke-worms inhabiting the shores of the ponds and pools.

An especially interesting case of fish acclimatization in outlying territory was the recent planting in the rice fields of the Hawaiian Islands of several thousand viviparous and other minnows from Texas, for the purpose of destroying mosquitoes. The mosquito-eating propensities of these species at home are well known, and it is reported that the fish have given a good account of themselves in Hawaii.

In the spring of 1907 a consignment of large-mouth black bass left San Francisco for the Philippine Islands, where the fish will be planted in closed waters pending a determination of the best points at which to liberate them and their progeny.

Among the Asiatic fishes now commonly found in the Hawaiian Islands are the carp, the gold-fish, a cat-fish, and a serpentheaded-fish—all introduced by Chinese or Japanese and used chiefly by those people. The carp and the gold-fish have also been introduced by them into the Philippines.

FOREIGN FISHES IN THE UNITED STATES

The introduction of foreign water animals into the United States has been much less extensive than the importation of plants and land animals, the primary reasons for this being the greater difficulties of transportation and the all-sufficient richness of our own waters in almost every kind of products. Quite a number of Old World fishes have been successfully planted in our waters, and some of them have become very well known in various parts of the country. The introduction of several others has been attempted, but has met with failure.

Two of the best-known European trouts—the brown trout and the Scotch lake trout, or Loch Leven trout—have been cultivated in the United States for a score of years by both national and state fishery bureaus. These fish have been planted chiefly in private waters, some of which have been well stocked;

but they are not so highly regarded or so valuable as our native trouts, and the demand for them is decreasing. The Swiss lake trout has been handled on a small scale for some years, and recently has been planted in some of the Adirondack lakes—very appropriate waters, where it should prove a valuable addition to the supply of game fishes. A number of fine, large examples have recently been caught, and the success of the plants seems assured. The sea trout of Europe, whose migrations to and from the rivers are quite similar to those of the salmon, has been under semi-domestication in New England for many years, and is now being cultivated in ponds at a number of places. The fish are not permitted to run to sea, but this enforced change of habit does not appear to influence them very unfavorably. As food and game they have no advantages over native species, and probably all that can be said in their favor is that they add to the variety of fishes useful for the stocking of private preserves or lake systems.

Other Old World fishes now very familiar in this country are the gold-fish or golden carp, the golden ide or golden orfe, the tench, and the paradise-fish. The gold-fish is native to China and Japan, where it has been cultivated for centuries, and it is now domesticated in nearly every civilized country. Many millions are raised annually by amateurs and professionals in the United States, and the money value of the gold-fish industry is really very great. The gold-fish and the golden ide are used almost wholly for ornamental purposes, although both have in some places escaped into ponds and streams and are occasionally seen in the markets. After a few generations in a wild state, the gold-fish loses its bright colors and reverts to the dull brown color of its Asiatic ancestors. The tench is a handsome species, with a rich brownish-green color and very fine scales; it is found in some numbers in the Potomac and perhaps in other streams, and it is now reaching the Washington market in small quantities, but its sluggish habits and carpish affinities will probably never permit it to attain a high reputation in this country, although it is esteemed in Europe, and is really a first-class table fish when taken from suitable waters. A pretty cultivated variety, of a bright golden-yellow color, with a few round brownish-red or blackish spots, is desirable for aquaria and fountains. The paradise-fish, a native of Burma, is a small aquariam species with interesting breeding habits.

THE CARP

The best-known, most widely distributed, and most important of our fish immigrants is the carp, usually called the German carp, a native of Asia, but cultivated for many centuries in Europe, whence were brought to this country about 30 years ago the improved varieties—the leather carp, blue carp, and mirror carp.

The carp has received an extraordinary amount of criticism, mostly unfavorable, during recent years; no other fish, in fact, has ever come in for so much vituperation. In some communities the carp question has at times overshadowed the tariff, the trusts, and high finance; and there are places where it is almost as much as a man's life is worth to raise his voice or lift his pen in favor of this Mongolian alien. Without entering into a discussion of the carp question and without undertaking to make any apology for the carp, it may be said that most of the attacks on its reputation have been unfair, and that a better knowledge of the objects and results of the introduction of the fish into American waters would greatly reduce the number of people who place the carp in the same category of nuisances as the English sparrow. Although small numbers of carp were imported by private individuals before the introduction and distribution of the species by the general government, the latter was solely responsible for the present continental distribution of the fish, and to it, as represented by the National Fish Commission, must be ascribed

whatever credit or blame is due. In his 1878 report to Congress, Professor Baird said:

"The carp has been domesticated in Europe from time immemorial, and represents among the finny tribe the place occupied by poultry among birds. It is a fish adapted to the farmer's ponds and to mill-dams, less so to clear, gravelly rivers with a strong current. Where there is quiet water, with muddy bottom and abundant vegetation, there is the home of the carp; there it will grow with great rapidity, sometimes attaining a weight of three to four pounds in as many years. It is a vegetable feeder and not dependent upon man for its sustenance. As an article of food, the better varieties rank in Europe with the trout, and bring the same price per pound."

The limitations of the carp, as thus defined and as recognized and acknowledged at the time of its introduction, have been to a great extent overlooked or ignored, and to this is to be attributed much of the carp's disrepute. It has been planted under conditions as inappropriate as would be the stocking of a game-bird preserve with foxes or the raising of rabbits in a meadow overrun with hounds.

The indictment against the carp in America is long and formidable. It is charged with being unfit for human food, with being very injurious to other and better fishes, and with being very destructive to ducks and other wild fowl by uprooting the wild celery on which they feed, to say nothing of various minor accusations.

It is not necessary to discuss these points, and it will suffice to say (1) that special investigation has shown the carp does exceedingly little harm to any other fish, as any one would expect from its known habits and anatomical peculiarities; (2) that the injury done to the feeding grounds of wild fowl has been grossly exaggerated; on one hand, a scarcity of ducks may occur entirely independently of the presence of carp, and, on the other, a great abundance of carp may be coexistent with an undiminished growth of wild celery; and (3) that the carp is a food fish of very great importance, and to say anything to the contrary is to ignore facts.

We may profitably dwell a little on this last point, because a few people are aware of the economic value of this fish at the present time or appreciate the rôle it must inevitably continue to play in this country, for the carp is already the most widely distributed American fish; it can no longer be regarded as an alien; and it is here to stay.

As a food fish the carp has many superiors. I do not eat it and see no reason why people so favorably situated as are those who live on the seaboards, the Great Lakes, and the various interior waters should eat carp; but there are millions of our people who can not obtain the delicious trout, shad, salmon, black bass, striped bass, halibut, mackerel, or smelt; or who, if they ever see these fish, find them, like the peas porridge of the nursery rhyme, "nine days old" or more and nine times inferior to a fresh carp. It is to the many people who must eat carp or no fish, or no better fish, that this food comes as a special boon, although the consumption, even in many of the eastern seacoast towns, is surprisingly large.

"The proof of the pudding is the eating"—one of the proofs of a fish is the price people are willing to pay in order to eat it. Judged by this standard, the carp is to be reckoned among the leading fishes of the United States. It is regularly exposed for sale in every large city and in innumerable small towns; and the fishermen find such ready sale for it at such good prices that in at least 15 states special carp fisheries are carried on, and in 35 states it is regularly taken for market. At this time the annual carp catch amounts to about 20 million pounds, for which the fishermen receive $500,000.

Illinois is not only the "sucker state"; it is preëminently the "carp state", and is not ashamed of the fact. It produces twice as many carp as any other state,

and its fishermen have for years been reaping a golden harvest, finding a ready sale in the west and also sending large consignments to New York in special cars. The next important center is the western end of Lake Erie, in Ohio and Michigan, where large special ponds have been constructed and a peculiar form of cultivation has sprung up. The ponds are designed primarily for retaining carp that have been seined in open waters until the price warrants shipment, and some of them have to be kept at a proper level by pumping or by the use of water elevators. The expense involved in the construction and maintenance of such works shows how remunerative the carp is. Other important carp states are Colorado, Delaware, Iowa, Minnesota, Missouri, New Jersey, New York, Tennessee, Utah, and Wisconsin.

It is not as a great market fish, however, that the carp is destined to attain its highest importance among us, but as a fish for private culture and home consumption. The number of farmers and small land-owners who are alive to the benefits of private fish ponds is increasing at a very rapid rate, and hundreds of thousands of such in all parts of the country, but particularly in the great central region, will find in the carp the species best adapted to their needs and conditions.

It is probable that the commercial value of carp is insignificant compared with its importance as a food for other fishes. It is extensively eaten by many of our most highly esteemed food fishes and is the chief pabulum of some of them in some places. In a number of the best black-bass streams, like the Potomac and the Illinois, the carp is very abundant and is a favorite food of the young and adult bass, while in California the introduced striped bass has from the outset subsisted largely on carp and may owe its remarkable increase to the presence of this food.

The consumption of carp is certainly destined to increase greatly; but even if the catch reaches no higher point, the introduction of the carp into the United States will remain the leading achievement in fish acclimatization in recent times, and, with the exception of the original introduction of the same fish into Europe from Asia, the most important the world has known.

American anglers for bass and trout and salmon, as a rule, have only contempt for the carp, and there is nothing so calculated to disturb the equanimity of the otherwise amiable disciples of Walton as the mention of carp. It is my firm conviction that the true basis for most of the unfriendly feeling toward the carp is the fact that this fish does not habitually rise to a fly and is not fitted by nature to inhabit the purling brook, the foaming cataract, the glacier-fed rivers, and the bottomless lakes where the fly-caster is wont to go. And yet to hold that the carp is beneath the attention of sportsmen is to ignore well-known facts and to acknowledge indifference to the classical tenets of angling. From earliest times the carp has been a favorite with the anglers of Germany and England; Isaac Walton himself devoted a chapter to it, and called it "the queen of rivers; a stately, a good, and a very subtile fish"; Cholmondeley-Pennell has shown that it is at times as fastidious a biter as a trout or bass; and Professor Goode has protested against the dictum of New World authorities in excluding from the class of game fishes the carp, the dace, the roach, and other pets of the father of angling, classical in sportsmen's literature, and affording "sport, which in England tens of thousands enjoy, to every one who gets the chance to whip a salmon or trout line over preserved waters."

THE FAILURES

In view of the foregoing splendid record of achievement, we should not be loath to acknowledge a number of failures to establish certain fishes and other water creatures in regions in which they were demanded and to which they appeared to be entirely adapted.

Between 1878 and 1888 five attempts

to introduce the English sole and turbot on our Atlantic coast were unsuccessful, owing probably to the comparatively small number of fish brought over and planted. There is no reason to doubt that these species could be readily established on our northeast coast, although it must be said that the sole and turbot, choice food fishes as they are, would not be unrivaled additions to our flat-fish fauna.

One of the most surprising failures has been the entire inability to establish the whitefish of the Great Lakes in Pend d'Oreile, Cœur d'Alene, and other large lakes of the northwest. Depth, temperature, and other conditions seem to be favorable, but for some unknown reason plants aggregating millions have been futile.

There is probably no food animal of the eastern seaboard whose acclimatization on the Pacific coast would prove such a boon as the lobster. The omission of the lobster from the Pacific fauna is regarded as a misfortune by the people of the west coast, and it was in response to this feeling that the Federal Fishery Bureau more than 30 years ago made its first move to supply the deficiency. Three other transhipments of adult lobsters were made, the last in 1889, the deposits being at various points from Monterey Bay to Puget Sound. No positive results having appeared, the Bureau renewed the attempt in the fall of 1906, and dispatched to Puget Sound a special carload of brood lobsters numbering more than all the previous plants combined, and further consignments will be made until the lobster is removed from the list of failures and recorded as a great financial and gastronomic success.

FURTHER WORK OF ACCLIMATIZATION

What opportunities and what necessities for further fish acclimatization the future has in store can only be conjectured, but there is no reason to believe that additional work will not become desirable, as a result of the depletion of waters of their native fishes, changes in the physical conditions of streams and lakes, etc., and to satisfy the longing for something new and something better that, like hope, "springs eternal in the human breast."

Among the measures that have been suggested and will no doubt in time be taken up are the transplanting of the diamond-back terrapin and the blue crab in the marshes and bays of California and the establishing of the giant crab of the Pacific coast along the shores of the North Atlantic states.

Foreign waters also may be drawn on to augment the supply of economic animals and to fulfill certain special requirements. Objects which have been under consideration are the Japanese dwarf salmon, the Japanese pearl oyster, and the Japanese edible oyster, the last being recommended for the cold waters of the northwest coast, where the Atlantic oyster is not able to perpetuate itself.

It has been suggested that the finer grades of Mediterranean toilet sponges might profitably be introduced into the waters of Florida, and the British government has considered the same project with reference to the Bahamas. Now, for all ordinary purposes, there are no better sponges produced anywhere in the world than on the gulf coast of Florida. The Florida sheepswool combines all the desirable qualities of a toilet sponge—softness, elasticity, durability. Another native sponge of excellent quality is the fine-meshed, smooth-surfaced yellow sponge, which ranks next to the sheepswool in economic value; but for special purposes some of the small, fine-textured, soft, Mediterranean sponges have no substitute, and large quantities are imported. Whereas the best Florida sponges command a maximum price of $5 per pound wholesale, the Levant toilet sponges sometimes sell for $50 per pound. It would be a splendid achievement to introduce such sponges and enable our own people to reap some of the benefits of so lucrative a fishery. The questions involved in the project are: (1) Can the sponges be successfuly transported from

southern Europe to Florida? and (2) Will the transplanted sponges retain their original qualities in a new environment, or will they, after a few generations, take on the harsh characters of the analogous Florida species, which are not at all suitable for toilet purposes?

It is quite remarkable that the cheapest and least useful of the Florida sponges—the so-called grass and glove sponges—should physically and commercially differ so markedly from their Mediterranean prototypes, while biologically they are so closely related.

While the transportation of living sponges from so great a distance certainly involves difficulties, they are perhaps not insurmountable. Experiments conducted by the Bureau of Fisheries have shown that sponges may safely be kept out of the water for 3 days, provided they are cool and moist—and it is probable that this time can be considerably extended under favorable conditions—while the installation of a small circulating plant on an ocean liner may make the transportation still easier. As to the other question, time alone can determine.

The project involves the cultivation of the imported sponges, and for this the Bureau has already prepared the way.

FISHES THAT BUILD NESTS AND TAKE CARE OF THEIR YOUNG*

THE belief long prevailed that fishes are indifferent to their eggs and young and leave them entirely to the care of Mother Nature. One who was more excellent as a man of letters than as a naturalist, but who wrote, nevertheless, a very readable work on Animated Nature, Oliver Goldsmith, in 1774, told his readers that "fishes seem, *all* except the whale kind, entirely divested of those parental solicitudes which so strongly mark the manners of the more perfect terrestrial animals." Many to the present time entertain that belief.

More than a score of centuries before Goldsmith, however, the greatest naturalist of antiquity, Aristotle, told of a kind of fish, inhabiting the largest river of Greece, the Macedonian Achelous, which, in the person of the male parent, exerted the greatest care of both eggs and young. That account, however, was overlooked or neglected, and even regarded with skepticism and as fabulous. The strange history of that fish—known to Aristotle as the glanis—will be told at length in later pages of this article. Its truthfulness has been vouched for, not by later observers of itself, but by studies of related fishes having analogous habits in a quarter of the world unknown to and undreamed of by Aristotle. Although the most detailed history of any fish by any ancient writer is connected with it in the philosopher's History of Animals, no reference to it appears in any modern popular work.

Many important details respecting the life histories and parental care of a large number of other fishes have been published from time to time and may be found in the publications of various societies or other periodicals, but such are closed books to most persons. Anyone who looks for information in the popular works on natural history of the day must inevitably be disappointed at the meagerness of the information given. Even in the voluminous German work, so well known as Brehm's Tierleben, the infor-

* This article is abstracted from "Parental Care Among Fresh Water Fishes." By Theodore Gill. Smithsonian Institution, 1907. Dr Gill's paper makes a monograph of about 125 pages, and contains many illustrations. It is full of facinating and new information on the subject.

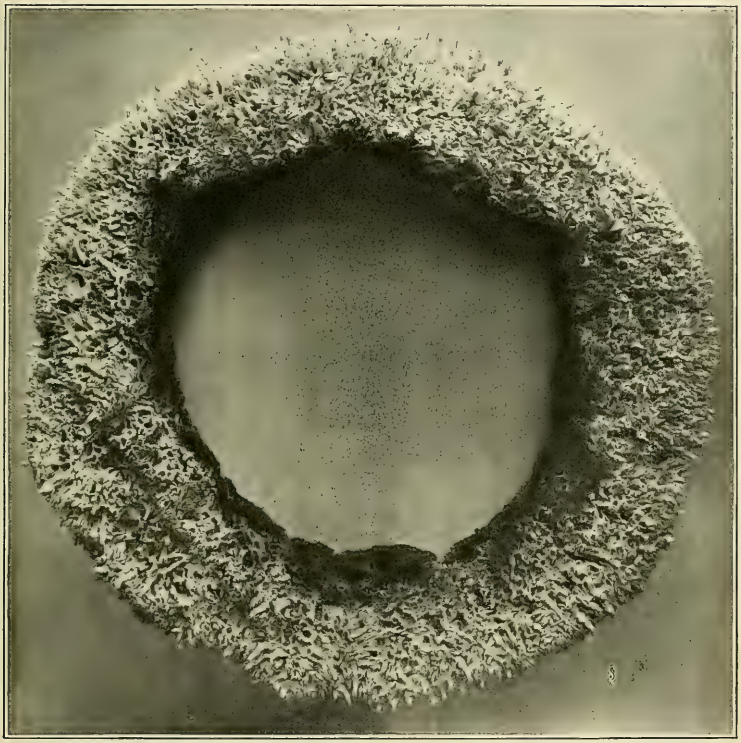


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

A Sheepswool Sponge of an Unusual Shape

From Matecumbe Key, Florida. Diameter of wreath, 30 inches; width of sponge proper, 7 inches; weight (dry), 1 pound 7 ounces. The sheepswool is the best sponge found on the shores of the western Atlantic, and, while coarser in texture than the best Mediterranean sponges, it is more durable (see page 399)

mation is meager for almost all fishes, and especially meager for American forms. The sources of knowledge have not been discovered by the compilers of such works, but he who might judge from the paucity of data that no others could be found would be much deceived. To uncover some of the interesting details hidden in comparatively little known journals and other works is the object of the present article.

The species which manifest care for their young are so numerous that the present article must be restricted to those which are inhabitants of fresh water. Such are better known than the marine

Photo from Hugh M. Smith, U. S. Bureau of Fisheries

Humpback Salmon from Alaska

Showing excessive development of the hump in males during breeding season. The introduction of this species into New England streams is now in progress (see page 393)

forms, as they are more easily observed and within the range of observation of a more numerous population. Considerable is known, however, of the habits of many of the dwellers in salt water. Parental care has been especially observed in the marine pipefishes, sea-horses, Pegasids, Solenostomids, Sparids (*e. g., Catharus*), Labrids (Wrasses), toad fishes, gobies, blennies, sculpins or Cottids, lumpfishes, Gobiesocids, etc.)

Naturally the most common or frequent mode of care is the simplest, consisting of little more than selection of a site for the deposit of the female's eggs and subsequent guardianship of those eggs by the male. In the case of the American sunfishes, black basses, and crappies, the place selected is cleared of stones and weeds, and in the cleared place the eggs are laid. Some of the sunfish-like Cichlids and the North American catfishes, as well as the Grecian glanis, exercise similar means with slight modifications. Another kind of catfish, living in North Australia (Queensland), lays her eggs in the center of a selected area of a river bed, and, after having fertilized them, the fish accumulates stones from the surrounding area and piles them in a heap over the eggs.

ARISTOTLE'S CATFISH

Aristotle 2,250 years ago described how this fish guarded its young, but the world for nearly as many years has laughed at his story. Recent investigations by Dr Theodore Gill, and others, of a similar fish in the United States, have

Seining Carp from a Pond—Sandusky River

The German carp has become exceedingly abundant in the western part of Lake Erie, where millions of pounds are caught annually (see pages 396–7)

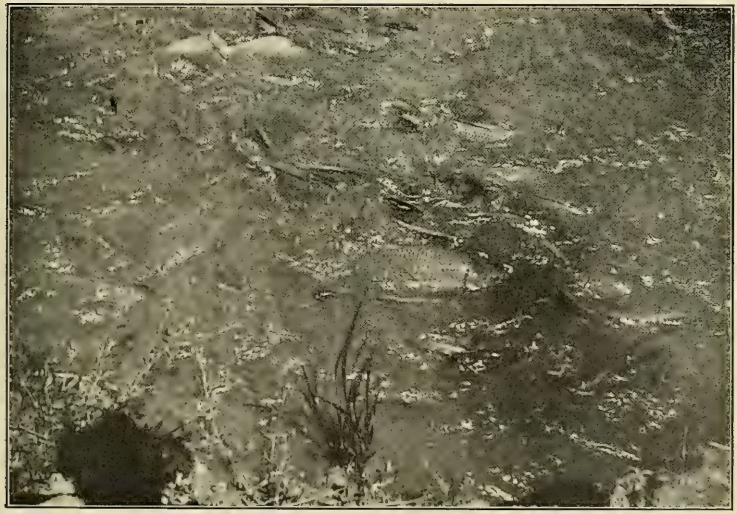


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

School of Carp Swimming against Inflowing Water, in Pond at Port Clinton, Ohio

Carp seined in open waters are retained in large enclosures or ponds until the condition of market warrants shipment (see pages 396–7)

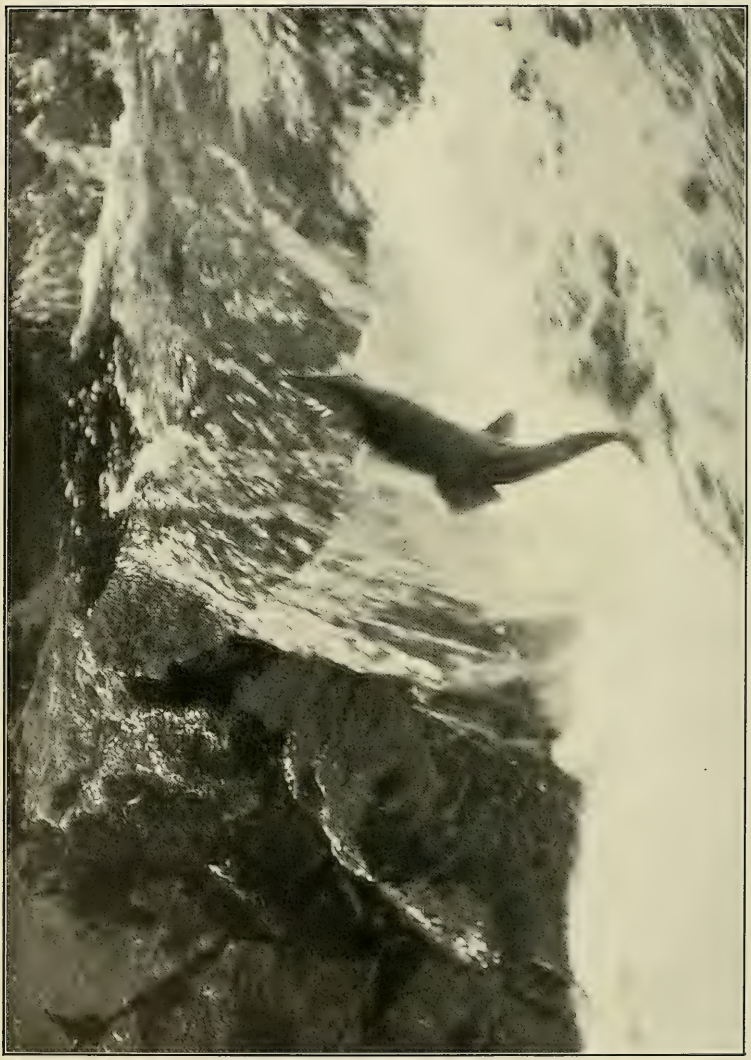


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

Salmon Ascending a Stream in Search of Spawning Ground

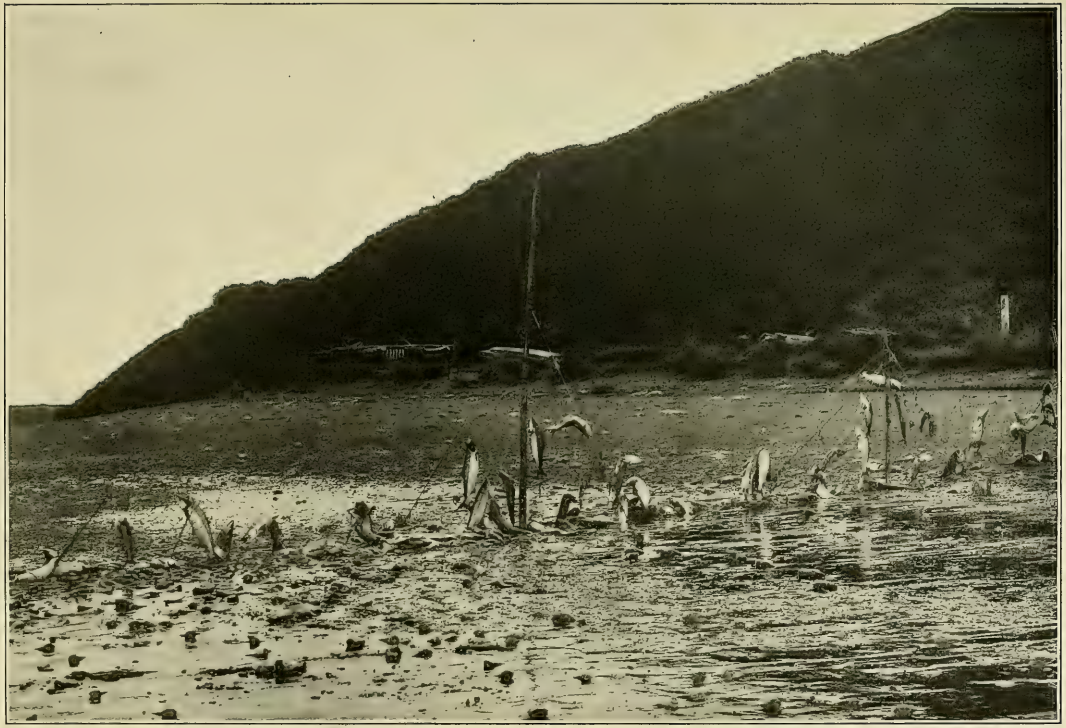


Photo from Hugh M. Smith, U. S. Bureau of Fisheries

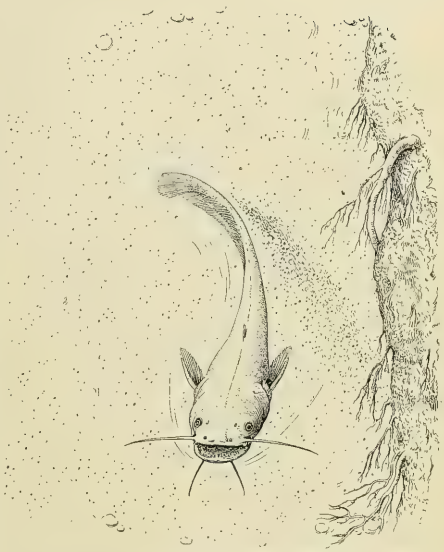
Salmon Caught in a Weir—Alaska

Photo from Hugh M. Smith, U. S. Bureau of Fisheries

Lake Herring Stored in a Refrigerating Plant

proved that the famous Greek philosopher told the truth. Aristotle wrote as follows (Book IX, Chapter 25, Section 6):

"Of the river fishes, the male glanis takes great care of its young. For the female, having brought forth, departs; but the male, where the greatest deposit of eggs has been formed, remains by them watching, rendering no other service except keeping off other fishes from destroying the young. He does this for forty or fifty days, until the young are sufficiently grown to escape from the other fishes. And he is known to the fishermen wherever he may chance to be watching his eggs; for he keeps off the fishes by rushing movements, and by making a noise and moaning. And he remains by the eggs with so much of natural affection that the fishermen, when the eggs adhere to deep roots, bring them up to the shallowest place they can; but he does not even then leave his offspring, but if he chance to be a young fish he is easily taken by the hook, because he snaps at all the fishes that approach him; but if he is already accustomed to this, and has swallowed hooks before, he does not even then desert his young, but breaks the hook by a very strong bite."



From Theodore Gill, Smithsonian Institution

Aristotle's Catfish (*Parasilurus Aristotelis*) on Nest (Ideal)

THE AMERICAN CATFISH

In cleaning out a nest, this catfish carries off pebbles from ½ to ¾ of an inch in diameter. Dr Hugh M. Smith thus describes the nest-building of a pair of catfish in an aquarium: "The pair of fish, during the first night they were in the aquarium, removed all the gravel from over a space nearly 2 feet long and 1 1/3 feet wide, upward of a gallon of stone being transferred to the end of the tank." A pint or more of gravel was then scattered on the nest by an attendant, but in a few minutes the fish had completely freed the nest again.

The male remains on guard for several weeks after the eggs are hatched, to protect the young fish.

THE BOWFIN OR MUDFISH

The bowfin is a strong and well-armed fish, both as to the bony armature of the head as well as the teeth. It is one of the large fishes, when fully mature attaining a length of over 2 feet, often 2½, or even somewhat more. As usual among fishes, the females average larger than the males. The males, apparently, are much more numerous.

The geographical range of the bowfin is quite extensive, and yet restricted in a peculiar way. It is not found in the New England States (except in Lake

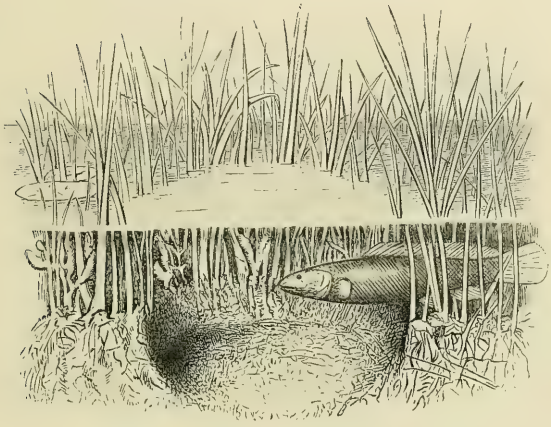
A Typical American Catfish (*A. nebulosus*) on Nest (Ideal)

Champlain) nor in the waters, flowing eastward, of the Middle States, but it is an inhabitant of the Great Lakes (except Superior) and of the Mississippi Basin, as well as of the Southern States up to Virginia and the Dismal Swamp.

Sluggish waters are its favorite haunts, and a couple of its names—mudfish and marshfish—indicate places in which they may be found.

The male constructs the nest unaided, scooping out the depression by rotating its body, and breaking young shoots with its snout. After the nest is constructed it awaits the coming of a mate.

The stock of eggs being provided, the male bowfin redoubles his guardianship. "At intervals he moves over the nest and *by the movements of his fins keeps the eggs free from sediment, which would otherwise smother them.*" *All the time he is on the outlook for intruders, and especially against other males.* One Reighard saw rushed at another male and "struck him with his head in the middle of the side and hurled him two feet from the nest." Generally there is no contest, for the rights of the nest-maker appear to be respected, but occasionally too great aggressiveness on the part of the occupant or audacity of an intruder results in a regular battle. Whitman and Eycleshymer tell of one: Two males that claimed a female were unwilling to yield one to the other, and "a fierce battle for supremacy ensued" between them. "They approached from opposite sides of the nest and locked jaws in a most ferocious manner. Their struggles were so violent that a cloud of muddy water soon arose



Nest of Bowfin, Commonly Known as the Dogfish or Mudfish.. After Dean

and obscured them from view." Eventually one of the males was left about the nest, and his attentions were accepted by the female, who, "during the battle, had remained concealed at the side of the nest."

A FISH WHICH MAKES A FLOATING NEST

The gymnarchus makes a large floating oblong nest, about 2 feet long and 1 foot wide on the outside, in the dense grasses of a swamp and in water 3 to 4 feet deep. In one, especially described by Budgett, "three sides of the nest projected from the water; the fourth side was several inches lower, being about two inches below the surface. The deepest part of the nest was opposite to that side where the wall was low, the bottom being about six inches below the surface of the water."

In one nest "were deposited about a

Floating Nest of *Gymnarchus,* which Inhabits the White Nile, the Senegal, and Niger Rivers and Lake Chad, in Africa. After Budgett

Three-spined Stickleback

Male laying the foundation of his nest, which would do credit to a bird. The fish glues together the pieces of which the nest is constructed with a spider-like thread, which it manufactures. After Coste

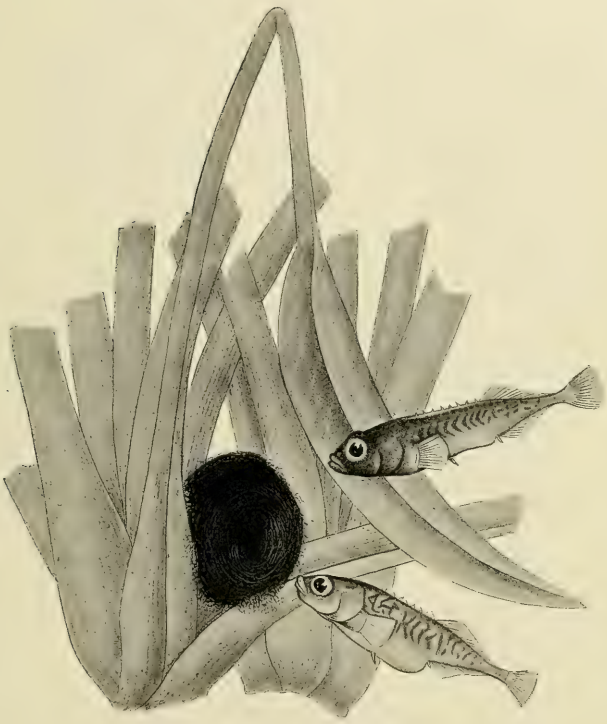
thousand spherical amber-like eggs 10 millimeters in diameter. The eggs hatched five days after being laid, and in eighteen days a thousand young fry," about three inches long, left the nest They were then essentially like the adults. Many of the young were secured by Budgett immediately after they had left their nest, and "lived well on chopped-up worms." He tried to take some to England, but every one died as soon as they "got into colder climes."

The native Africans "approach these nests with great caution, stating that the parent is at this time extremely fierce and has a very formidable bite."

THE STICKLEBACK

The stickleback of all fishes probably shows the greatest ingenuity and zeal in the protection of its offspring; but it is the male, and not the female, that exercises parental care; he it is that builds a nest that would do credit to a bird, and drives or entices the full female to enter into it and deposit her ripe burden. When a sufficient supply of eggs has been secured, the male closes the nest and remains in charge till the young have

Stickleback Male Rotating in His Nest to make it Tubular for the Female
After Coste



Nest of Ten-spined Stickleback.

Female preparing to enter a nest to lay her eggs. After Coste

reached a size which he considers to be sufficient to enable them to wander away and seek their own living.

The stickleback is very common in America and Europe, varieties of this tiny fish being found in almost every permanent body of water, however small.

One instance illustrative of their occasional extraordinary numbers has been often quoted, but is as apt now as ever. In 1776 Pennant claimed that "once in seven or eight years amazing shoals appear in the Welland" Canal "and come up the river in the form of a vast column. They are supposed to be the multitudes which have been washed out of the fens by the floods of several years and collected in some deep hole till, overcharged with numbers, they are periodically obliged to attempt a change of place. The quantity is so great that they are used to manure the land, and trials have been made to get oil from them. A notion may be had of this vast shoal by saying that a man employed by the farmer to take them has got for a considerable

time 4 shillings a day by selling them at a half penny a bushel."

This account has been quoted as unparalleled, but several notices in American publications come nearly, if not fully, up to it. In the Canadian Annual Report on Fisheries for 1863 (p. 61) it is reported that the three-spined stickleback or picassou was "caught in great quantities in the small rivers, brooks, and *barachois* of Magdalen Islands, where it is used as food for cattle and as manure," and that "400 barrels were caught" in 1862 "in the *barachois* of Basque Harbor" alone. Four hundred barrels were also caught in 1866 and sold as manure at 25 cents per barrel, but in 1867 the catch was smaller (150 barrels) and prices advanced to "1s. 3d. per barrel."

A FISH THAT BUILDS A COCOON FOR ITSELF

Dr Gill also describes a peculiar fish found in tropical Africa north of the Congo Basin and known as the *Protopterus annectens*. This fish lives mostly in shallow, muddy waters or swamps which dry up during the rainless season. When the water disappears the fish burrows down into the mud and builds around itself a sort of cocoon by means of a mucous which it discharges. In this cocoon it will live for months at a time in a semi-lethargic condition. It receives air to breathe through a tube which leads from the cocoon to the surface. When the dry season ends and the rain returns, the fish emerges from its hiding place. The naturalists have known for a good many years about this fish, but it was not until 1901 that Mr J. S. Blodgett succeeded in obtaining a number of the nests,

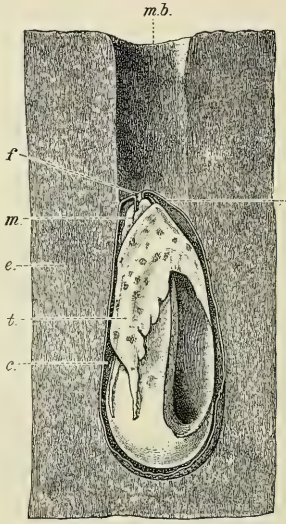


Diagram of the cocoon which a certain fish builds to retain moisture for itself in the dry season (see below). *c*, cocoon; *e*, earth; *f*, funnel leading to mouth of fish; *l*, lid; *m*, mouth; *mb*, mouth of burrow; *t*, tail. After Parker.

which he brought to England. The fish are quite large; all the males found by Mr Blodgett exceeded 18 inches in length. These fish are highly esteemed by the African negroes, who hunt for the cocoons in the dried-up swamps and carry them off for future use. The flesh is described as very soft and white.

Protopterus annectens. After Lankester

Illustration of the fish which builds a cocoon to protect itself. The fish averages about 16 inches

NOTES ON THE REMARKABLE HABITS OF CERTAIN TURTLES AND LIZARDS*

By H. A. Largelamb

THE ALLIGATOR SNAPPING TURTLE

THE alligator snapping turtle (*Macrochelys lacertina*) is found in the Mississippi River and the other rivers flowing into the Gulf of Mexico, all the way from Texas to Florida and as far north as Missouri.

Although turtles are not provided with teeth, the bite of this giant turtle may well be feared, for it is quite capable of snapping off a finger or hand at a single bite. It possesses a pair of keen-edge cutting mandibles and jaw muscles of great power. It snaps off a large section of a fish like a shad as cleanly as though removed with a cutting die. It is unable, however, to swallow its food unless its head is completely immersed. If kept in water too shallow for this, it would starve in the midst of plenty. It could take the food, but could not swallow it.

The alligator snapping turtle, when lying at the bottom of the muddy water it frequents, can hardly be distinguished from a great boulder stone embedded in the mud. It is provided with a very remarkable appendage, which it uses to entice fish right into its mouth. The appendage is found on the inside of the lower jaw, close to the region of the tongue. Mr Raymond Lee Ditmars, in his fascinating book upon Reptiles, says:

"This is a well-developed filament of flesh, white, and distinct from the yellowish mouth parts, and resembling a large grub to such a degree of nicety that the popular-minded observer, seeing the object in the reptile's mouth, would declare it to be the larva of some insect. More striking, however, is the reptile's power to keep this appendage in motion, giving it the aspect of crawling about in a small, circular course.

"With the mud-colored shell lying close to the bottom, the jaws thrown open to a great extent, this organ is put in motion. Every other portion of the creature is as motionless as a rock. In this position of rigidity the shell looks like a great, round stone, and blotches of fine waving moss intensify the deception; the big head looks like another stone, beneath which there is a cavern, and in this cavern crawls the white grub, to all appearances, an object dear to the hearts of finny wanderers. But woe to the luckless fish that swims within reach of those yawning jaws."

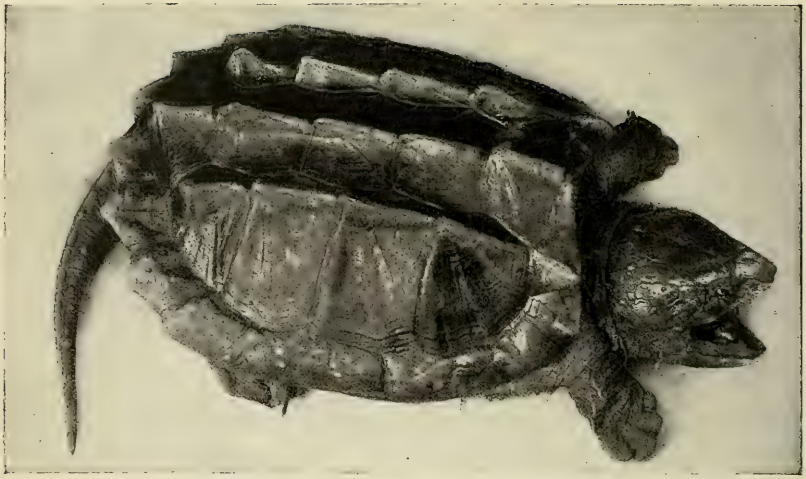
LIZARDS' TAILS

We are all more or less familiar with the difficulty of catching lizards without causing them to lose their tails. The tails come off on the slightest provocation. This decapitation—or, rather, decaudation—is not of so much consequence to a cold-blooded reptile as it would be to a mammal, like a dog or cat; for the lizard soon grows another tail, which, though it may not equal the original tail in length, is yet a good serviceable organ. How many times the tail may be removed and yet be replaced we do not know.

The removal of the tail is not always the result of violence, for some lizards, the plated lizards, for example, are able to discard the tail voluntarily in the face of an enemy. The abandoned tail acts as a decoy to the pursuer. The tail wriggles and writhes and thrashes about with such liveliness among the dead leaves into which it is thrown as to distract the attention of the pursuer, and thus the original owner escapes.

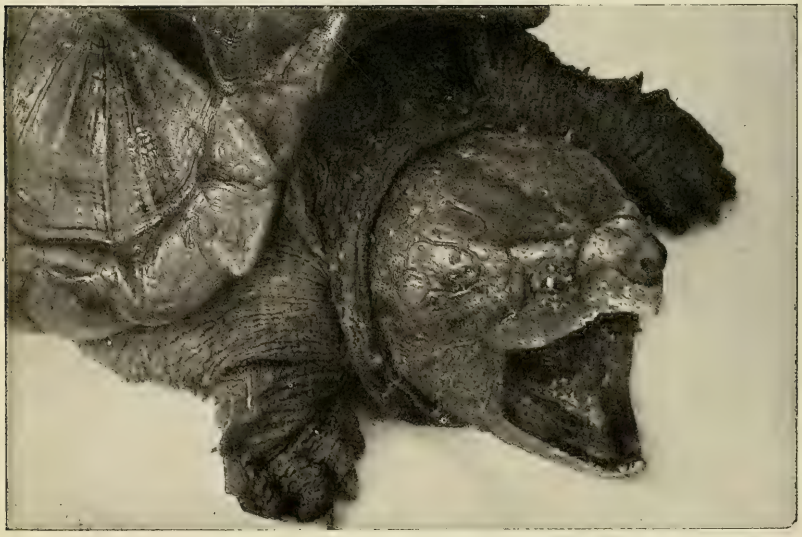
The glass "snake," which is really a lizard, although it has no feet, is unable to make much speed; and for this reason

* A review of "The Reptile Book," by Raymond L. Ditmars, Curator of Reptiles in the New York Zoölogical Park, with 8 plates in color and more than 400 photographs from life. Pp. 475. 10 x 8 inches. New York: Doubleday, Page & Co. 1907.



Alligator Snapping Turtle, *Macrochelys lacertina*

Distinguished from the common snapping turtle by the absence of the broad plates under the tail, the yellowish color, and much larger size. Reaches a weight of 140 pounds. Inhabits rivers emptying into the Gulf of Mexico



Photos from "The Reptile Book," by Ditmars. Copyright, 1907, by Doubleday, Page & Co.

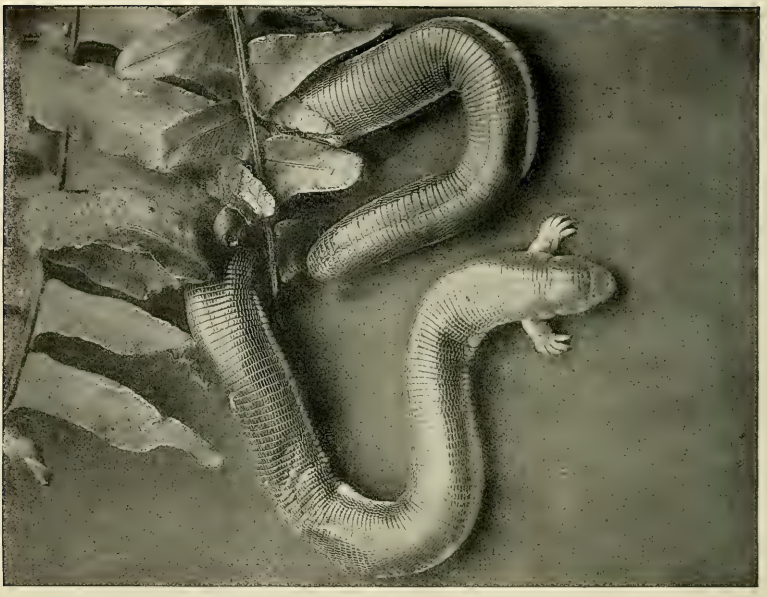
Head of the Alligator Turtle, *Macrochelys lacertina*

The jaws of a large specimen could readily amputate a man's hand or foot

Plated Lizard, *Gerrhonotus imbricatus*—a Western Species

Glass "Snake," *Ophisaurus ventralis*

A snake-like representative of the *Anguidæ*, inhabiting the Southern States. Several very similar species are found in Europe and Asia



Two-footed Worm Lizard, *Lipes caniculatus*

Worm-like and practically blind, this degenerate lizard leads a subterraneous life, burrowing long tunnels, through which it moves backward or forward

it is very easily overtaken by its enemy, the king snake. As the pursuer catches up with his prey he grasps at once at the first part offered.

"There is a sudden twisting movement on the part of the glass 'snake,' and the victor finds that the smooth, scaly length he holds in his jaws is so vigorous that it requires much attention, for it twists and wriggles with great energy. Swallowing all his prey head first, the cannibal works his jaws along the victim to engulf it from such a position, when, after much maneuvering with the writhing quarry, the snake stops in some embarrassment. There is no head. The object that has engaged so much attention is simply the long tail of the lizard, and the abbreviated owner has glided to safety."

HORNED LIZARDS

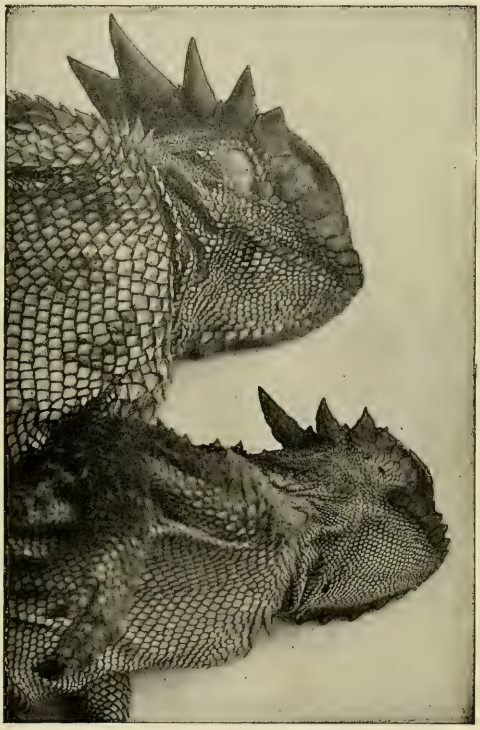
The expulsion of jets of blood from the corner of the eye is a remarkable habit sometimes attributed to horned lizards. We can hardly wonder that so eminent an observer as Raymond Lee Ditmars, Curator of Reptiles in the New York Zoölogical Park, after having examined several hundred specimens without observing the effect, should have become somewhat skeptical about the alleged habit. His skepticism, however, has been suddenly dispelled with a rather startling denouement.

Having received an unusually large and fat specimen of a Mexican horned lizard (*Phrynosoma orbiculare*), he photographed the specimen and then began to measure it.

"The latter process," he says, "seemed to greatly excite the creature. It finally threw the head slightly upward, the neck became rigid, the eyes bulged from the sockets, when there was a distinct sound like that produced if one presses the tongue against the roof of the mouth and forces a small quantity of air forward. This rasping sound, consuming but the fraction of a second, was accompanied by a jet of blood at great pressure. It hit the wall, four feet away, at the same level as that of the reptile. The duration of the flow of blood appeared to be about one and a half seconds, and toward its termination the force gradually diminished, as noted by a course of drops down the wall and along the floor to a position almost under the spot where the reptile had been held. The stream of blood seemed to be as fine as horse hair and to issue from the eyelid, which was momentarily much swollen.

"For some time after the performance the eyes were tightly closed and nothing could induce the lizard to open them. Within two minutes after it was placed on the ground the protruding aspect of the eyeballs and the swelling of the eyelids had disappeared.

"Most surprising was the amount of blood expended. The wall and floor showed a course of thickly sprinkled spots about one-eighth of an inch in diameter. There were 103 of these spots."



Heads of Horned Lizards

The above quotation is also taken from "The Reptile Book," by Raymond Lee Ditmars, published by Doubleday, Page and Company, 1907. This book is an admirably written and well illustrated work on the structure and habits of the Turtles, Tortoises, Crocodilians, Lizards, and Snakes which inhabit the United States and northern Mexico.

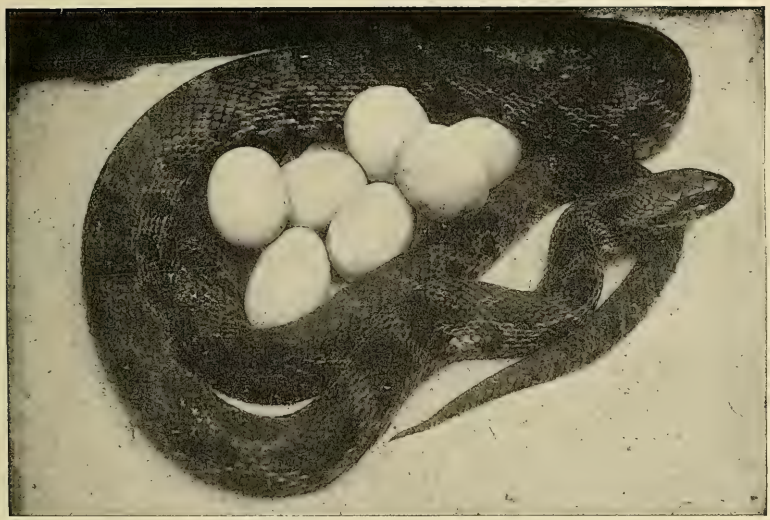
While thoroughly scientific in its treatment of the subject, the work is written largely in untechnical language and the illustrations are the best we have seen.

Regal Horned Lizard, *Phrynosoma regale*

A showy species of the southwestern deserts. The only member of its genus having four central occipital horns. These and the temporal horns produce the effect of a circlet or crown. The horns are often pinkish

Pacific Horned Lizard, *Phrynosoma coronatum*

Most nearly allied to the Regal Horned Lizard, but differing in the more elongate body, the thicker and longer tail and in having only two occipital horns. Inhabits southern California and Lower California



Fox Snake, *Coluber vulpinus,* and Her Eggs

Eggs of the Corn Snake, *Coluber guttatus*

Eggs of the Green Snake, *Liopeltis vernalis*

Milk Snake, *Ophibolus doliatus triangulus,* and Her Eggs

Breeding Habits of Snakes

COMMERCIAL AND FINANCIAL STATISTICS OF THE PRINCIPAL COUNTRIES OF THE WORLD.

From "Statistical Abstract of the United States, 1906." By O. P. Austin, Chief U. S. Bureau of Statistics.

NOTE.—United States equivalents of the following monetary units: *Argentina:* Paper peso (1905)=42.5 cents. *Bolivia:* Boliviano (1905)=44 cents; (1906)=47.7 cents. *Brazil:* Milreis (1905-6)=30.4 cents. *China:* H. Tael (1905)=73.6 cents. *Costa Rica:* Colon (1905-6)=46.5 cents. *Greece:* Paper drachma (1905-6)=15.7 cents. *Haiti:* Paper peso (1905-6)=25 cents. *Honduras:* Silver peso (1904-5)=43 cents. *Nicaragua:* Peso curr. (1905)=17 cents. *Paraguay:* Paper peso (1906)=8 cents. *Portugal:* Milreis curr. (1905)=99.2 cents. *Salvador:* Peso (1905)=44.1 cents. *Siam:* Tical (1905-6)=30 cents. *Spain:* Peseta curr. (1906)=17.1 cents. *Turkey:* £T=$4.40.

Country.	Area.	Population.	Population per square mile.	Foreign Commerce. Year.	Imports of Merchandise.	Imports from the United States.	Per cent imports from U. S.	Exports of Merchandise.	Exports to the United States.	Per cent exports to U. S.
	Sq. miles.				Dollars.	Dollars.		Dollars.	Dollars.	
Argentina	1,135,840	5,678,000	5.00	1905	197,974,000	27,908,000	14.10	311,544,000	15,167,000	4.87
Australasia { Australia	2,972,573	4,048,000	1.36	1905	[1] 186,614,000	21,834,000	11.70	[1] 276,617,000	5,109,000	1.85
Australasia { New Zealand	104,751	889,000	8.49	1905	[2] 62,432,000	7,000,000	11.21	[2] 76,190,000	3,486,000	4.58
Austria-Hungary	241,333	47,355,000	196.22	1905	435,665,000	41,347,000	9.49	455,487,000	10,751,000	2.36
Austria	[3] 115,903	[3] 27,241,000	235.03							
Hungary	[3] 125,430	[3] 20,114,000	160.36							
Belgium	11,373	7,161,000	629.65	1905	585,603,000	46,748,000	7.98	446,439,000	17,813,000	3.99
Bolivia	729,000	2,180,000	2.99	1905	8,952,000	756,000	8.45	13,024,000	27,000	.21
Brazil	3,219,000	14,334,000	4.45	1905	144,775,000	14,961,000	10.33	216,668,000	89,109,000	41.13
Bulgaria	38,080	4,015,000	105.44	1905	23,594,000	274,000	1.16	28,556,000	272,000	.95
Canada	3,048,710	6,441,000	2.11	[4] 1906	283,282,000	168,798,000	59.59	218,182,000	66,353,000	30.41
Central America { Costa Rica	23,000	323,000	14.04	1905	5,239,000	2,706,000	51.65	8,138,000	3,836,000	47.14
Central America { Guatemala	46,774	1,804,000	38.57	1905	6,844,000	2,707,000	39.55	8,238,000	2,875,000	34.90
Central America { Honduras	46,250	745,000	16.11	1905	2,293,000	1,690,000	73.70	5,564,000	4,623,000	83.09
Central America { Nicaragua	49,200	500,000	10.16	1904	3,202,000	1,668,000	52.09	3,926,000	2,089,000	53.21
Central America { Salvador	7,225	1,007,000	139.38	1905	4,346,000	1,355,000	31.18	5,640,000	1,225,000	21.72
Chile	279,901	3,239,000	11.57	1905	71,868,000	7,129,000	9.92	103,223,000	15,693,000	15.20
China	4,277,170	433,553,000	101.36	1905	339,439,000	56,611,000	16.68	167,726,000	19,895,000	11.86
Colombia	504,773	4,000,000	7.92	1904	[5] 14,453,000	[6] 4,936,000	34.15	[5] 12,658,000	[6] 6,837,000	54.01
Cuba	43,000	1,573,000	36.58	1905	94,807,000	42,082,000	45.34	110,168,000	95,331,000	86.53
Denmark	15,360	2,574,000	167.58	1905	[7] 166,837,000	[7] 26,832,000	16.08	[7] 142,991,000	[7] 5,529,000	3.87
Ecuador	116,000	1,400,000	12.07	1905	7,657,000	2,210,000	28.86	9,035,000	2,468,000	27.32
Egypt	383,900	9,821,000	25.58	1905	106,591,000	2,411,000	2.26	100,641,000	6,218,000	6.18
France	207,054	39,300,000	189.81	1905	922,329,000	98,874,000	10.72	939,305,000	56,916,000	6.06
Algeria	184,474	5,232,000	28.36	1905	74,090,000	648,000	.87	44,151,000	313,000	.71
Tunis	51,000	1,820,000	35.69	1905	17,554,000	267,000	1.52	11,247,000	21,000	.19
French East Indies	461,196	18,346,000	39.78	1904	36,792,000			36,073,000		
French colonies, not elsewhere specified	3,375,602	26,427,000	7.83	1904	42,654,000	2,997,000	7.03	36,337,000	305,000	.84
German Empire	208,830	60,478,000	289.60	1905	1,696,660,000	236,082,000	13.91	1,364,131,000	129,054,000	9.46
German colonies	1,025,829	12,632,000	12.31	1904	8,666,000	173,000	2.00	5,837,000	10,000	.17
Greece	25,014	2,434,000	97.31	1904	26,441,000	293,000	1.11	17,480,000	810,000	4.63

Haiti	10,204	1,347,000	132.01	1901	5,500,000	1,956,000	35.56	12,760,000	1,128,000	8.84
India, British	1,766,642	294,361,000	166.62	1905	338,750,000	4,992,000	1.47	513,563,000	31,505,000	6.13
Italy	110,646	33,604,000	303.71	1904	369,351,000	46,106,000	12.48	308,263,000	36,853,000	11.95
Eritrea (Massoua)	50,193	280,000	5.58	1904	1,501,000	29,000	1.93	543,000	.....	.....
Japan	147,655	47,975,000	324.91	1905	243,292,000	51,935,000	21.35	158,508,000	46,724,000	29.48
Formosa	13,458	3,059,000	227.30	1905	12,175,000	573,000	4.71	12,097,000	1,714,000	14.17
Kongo Free State	920,000	19,000,000	20.65	1905	3,875,000	6,000	.16	10,235,000	.....	.....
Korea	84,400	[8] 12,000,000	142.18	1905	15,916,000	985,000	6.19	3,438,000	.....	.....
Mexico	767,060	13,606,000	17.74	[4] 1906	[2] 109,884,000	[2] 72,509,000	65.99	[2] 135,027,000	[2] 92,633,000	68.60
Netherlands	12,563	5,592,000	445.12	1905	1,030,918,000	96,747,000	9.38	799,694,000	32,702,000	4.08
Dutch East Indies	736,400	35,736,000	48.53	1904	77,973,000	1,298,000	1.66	117,635,000	9,704,000	8.25
Norway	124,130	2,311,000	18.62	1905	83,706,000	2,157,000	2.58	50,631,000	1,186,000	2.34
Paraguay	157,722	636,000	4.03	1904	3,566,000	125,000	3.51	3,179,000	.....	.....
Persia	628,000	7,654,000	12.19	1904–5	26,943,000	118,000	.44	19,093,000	29,000	.15
Peru	713,859	4,500,000	6.30	1904	20,916,000	3,761,000	17.98	19,790,000	1,849,000	9.34
Portugal	36,038	5,162,000	143.24	1904	67,006,000	4,779,000	7.13	33,169,000	643,000	1.94
Portuguese colonies	806,746	7,270,000	9.01	1903	32,187,000	1,844,000	5.73	23,108,000	31,000	.01
Roumania	50,700	6,480,000	127.81	1905	65,145,000	.....	.....	88,221,000	.....	.....
Russia	8,660,395	141,000,000	16.28	1904	335,472,000	32,407,000	9.66	518,288,000	2,247,000	.43
Finland	144,255	2,857,000	19.81	1905	51,770,000	.....	.....	47,824,000	.....	.....
Santo Domingo	18,045	610,000	33.80	1905	2,737,000	1,961,000	71.65	6,881,000	4,484,000	65.16
Servia	18,630	2,689,000	144.34	1905	10,731,000	251,000	2.34	13,895,000	.....	.....
Siam	236,000	5,000,000	21.19	1905	[9] 17,404,000	[9] 277,000	1.60	[9] 29,043,000	.....	.....
Spain	194,783	18,618,000	95.58	1904	175,740,000	19,704,000	11.21	171,962,000	5,307,000	3.08
Sweden	172,876	5,261,000	30.43	1905	153,780,000	11,109,000	7.22	120,657,000	2,644,000	2.20
Switzerland	15,976	3,459,000	216.51	1905	266,311,000	10,986,000	4.13	187,079,000	24,134,000	12.90
Turkey	1,115,046	24,932,000	22.36	1900–1	104,903,000	[6] 260,000	.25	65,582,000	[6] 1,808,000	2.76
United Kingdom										
British colonies, not elsewhere specified	121,371	43,221,000	356.11	1905	[7] 2,749,669,000	[7] 562,436,000	20.45	1,605,053,000	116,387,000	7.25
	951,333	15,010,000	15.78	1904	[2] 501,956,000	[2] 37,753,000	7.52	[2] 440,692,000	[2] 36,688,000	8.33
United States	[10] 3,624,122	[10] 84,154,000	[10] 23.22	[4] 1906	[7] 1,226,554,000	.....	.....	1,717,953,000	.....	.....
Philippine Islands	115,000	7,635,000	66.39	[4] 1906	25,799,000	4,334,000	16.80	31,917,000	11,579,000	36.28
Porto Rico	3,435	[8] 1,000,000	.....	.....	.....	.....	.....	.....	.....	.....
Uruguay	72,210	1,038,000	14.37	1904	21,938,000	2,121,000	9.67	39,793,000	2,137,000	5.37
Venezuela	593,940	2,591,000	4.36	[4] 1906	8,676,000	2,622,000	30.22	15,630,000	4,862,000	31.11
Total	46,026,045	1,578,957,000	.....	.....	13,739,697,000	1,798,338,000	.....	12,496,419,000	1,031,113,000	.....
Total, exclusive of the commerce of the U. S.	.....	.....	.....	.....	12,513,143,000	1,798,338,000	14.37	10,778,466,000	1,031,113,000	9.57

[1] Exclusive of intercolonial commerce, but including bullion and specie.
[2] Including bullion and specie.
[3] Not included in total.
[4] Year ending June 30.
[5] Exports from and imports into principal countries in their trade with Colombia.
[6] Exports from the United States into and imports into the United States from the respective country.
[7] General trade.
[8] Estimated.
[9] Trade of Bangkok only.
[10] Including Alaska and Hawaii, but exclusive of Porto Rico; estimates of population furnished by the Census Bureau as per date June 1, 1906.

Year.	Population June 1.	GOVERNMENT FINANCE, PER CAPITA.							Production per capita of—		INTERNAL REVENUE.		Merchandise imported for consumption per capita.	CUSTOMS REVENUE.			POST-OFFICE DEPARTMENT.		PUBLIC SCHOOLS.		Year.
		Amount of money in the United States July 1.	Money in circulation July 1.	Debt, less cash in Treasury, July 1.	Year ended June 30.				Gold.	Silver.	Collected per capita.	Expenses of collecting.		Duty collected per capita.	Average ad valorem rate of duty.		Expenses of collecting.	Revenue per capita.	Expenditure per capita.	Population 5 to 18 years of age.	Expenditures per capita of population 5 to 18 years of age.	
					Interest on public debt.	Net revenue.	Net expenses.	Disbursements for pensions.							On dutiable.	On free and dutiable.						
		Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Per cent.*	*Dollars.*	*Dollars.*	*Per cent.*	*Per cent.*	*Per cent.*	*Dolls.*	*Dolls.*	*Millions.*	*Dollars.*	
1871..	39, 555, 000	18.75	18.10	56.81	2.83	9.69	7.39	0.84	1.11	0.60	3.62	5.30	12.65	5.12	43.95	38.94	3.18	0.51	0.62	12.3	5.62	1871
1872..	40, 596, 000	18.79	18.19	52.96	2.56	9.22	6.84	.74	.89	.72	3.22	4.36	13.80	5.23	41.35	37.00	3.21	.54	.66	12.6	5.90	1872
1873..	41, 677, 000	18.58	18.04	50.52	2.35	8.01	6.97	.70	.86	.86	2.75	4.69	15.91	4.44	38.07	26.95	3.76	.55	.70	12.8	5.95	1873
1874..	42, 796, 000	18.83	18.13	49.17	2.31	7.13	7.07	.71	.78	.86	2.39	4.40	13.26	3.75	38.53	26.88	4.49	.62	.75	13.1	6.11	1874
1875..	43, 951, 000	18.16	17.16	47.53	2.20	6.55	6.25	.68	.76	.69	3.52	3.89	11.97	3 51	40.62	28.20	4.47	.61	.79	13.4	6.23	1875
1876..	45, 137, 000	17.52	16.12	45.66	2.11	6.52	5.87	.63	.88	77	2.59	3.38	10.29	3.22	44.74	30.19	4.53	.63	.74	13.7	6.06	1876
1877..	46, 353, 000	16.46	15.58	43.56	2.01	6.07	5.21	.62	1.01	.80	2.56	2.99	9.49	2.77	42.89	26.68	4.96	.59	.72	14.0	5.67	1877
1878..	47, 598, 000	16.59	15.32	42.01	1.99	5.42	4.98	.56	1.08	.85	2.32	2.96	9.21	2.67	42.75	27.13	4.47	.62	.72	14.4	5.49	1878
1879..	48, 866, 000	21.15	16.75	40.85	1.71	5.60	5.46	.69	.80	72	2.32	3.10	8.99	2.73	44.87	28.97	3.96	.62	69	14.7	5.18	1879
1880..	50, 155, 783	23.64	19.41	38.27	1.59	6.65	5.34	1.14	.72	.69	2.47	2.95	12.51	3.64	43.48	29.07	3.22	66	.73	15.1	5.17	1880
1881..	51, 316, 000	26.30	21.71	35.46	1.46	7.00	5.08	.98	.68	73	2.64	3.20	12.68	3.78	43.20	29.75	3.22	.72	.77	15.4	5.43	1881
1882..	52, 495, 000	26.85	22.37	31.91	1.09	7.68	4.91	1.03	.62	.78	2.79	2.80	13.64	4.12	42.66	30.11	2.95	.80	.77	15.7	5.67	1882
1883..	53, 693, 000	27.42	22.91	28.66	.96	7.41	4.94	1.13	.56	.74	2.69	3.06	13.05	3.92	42.45	29.92	3.07	.85	.81	16.0	6.05	1883
1884..	54, 911, 000	27 08	22.65	26.20	.87	5.36	4.44	1.04	56	.76	2.21	3.47	12.16	3.47	41.61	28.44	3.44	.79	.86	16.4	6.29	1884
1885..	56, 148, 000	27.38	23.02	24.59	.84	5.76	4.63	1.17	.57	.76	2.00	3.42	10.32	3.17	45.86	30.59	3.58	.16	.89	16.7	6.61	1885
1886..	57, 404, 000	27.20	21.82	22.34	.79	5.86	4.22	1.13	.61	.69	2.03	3.06	10.89	3.30	45.55	30.13	3.33	.77	.88	17.1	6.63	1886
1887..	58, 680, 000	27.84	22.45	20.03	.71	6.33	4.56	1.27	.56	.70	2.02	3.22	11.65	3.65	47.10	31.02	3.16	.83	.91	17.4	6.65	1887
1888..	59, 974, 000	28.20	22.88	17.72	.65	6.32	4.46	1.33	.55	.72	2.07	2.92	11.38	3.60	45.63	29.99	3.27	.88	.94	17.8	6.98	1888
1889..	61, 289, 000	27.06	22.52	15.92	.53	6.31	4.88	1.45	.53	.76	2.13	2.88	12.10	3.60	45.13	29.50	3.14	.92	1.01	18.2	7.28	1889
1890..	62, 622, 250	26.91	22.82	14.22	.47	6.43	5.07	1.71	.52	91	2.28	2.65	12.35	3.62	44.41	29.12	2.98	97	1.11	18.5	7.60	1890
1891..	63, 844, 000	26.28	23.42	13.34	.37	6.14	5.73	1.95	.52	.90	2.28	2.75	13.38	3.40	46.28	25.25	3.17	1.03	1.14	18.8	7.85	1891
1892..	65, 086, 000	26.92	24.56	12.93	.35	5.45	5.30	2.07	.51	.86	2.36	2.52	12.50	2.68	48.71	21.26	3.74	1.09	1.19	19.2	8.12	1892
1893..	66, 349, 000	26.21	24.03	12.64	.35	5.81	5.78	2.40	.54	.71	2.43	2.57	12.73	3.00	49.58	23.49	3.32	1.14	1.27	19.6	8.31	1893
1894..	67, 632, 000	26.69	24.52	13.30	.38	4.40	5.43	2.09	.58	.46	2.17	2.55	9.41	1.92	50.06	20.25	5.15	1.11	1.27	20.1	8.49	1894
1895..	68, 934, 000	26.39	23.20	13.08	.42	4.54	5.16	2.05	.68	.53	2.08	2.62	10.61	2.17	41.75	20.23	4.43	1.12	1.31	20.4	8.60	1895
1896..	70, 254, 000	25.62	21.41	13.60	.49	4.65	5.01	1.98	.76	.56	2.09	2.62	10.81	2.23	39.95	20.67	4.52	1.17	1.34	20.9	8.84	1896
1897..	71, 592, 000	26.62	22.87	13.78	48	4.85	5.11	1.97	.80	.45	2.05	2.46	11.02	2.41	42.17	21.89	4.01	1.15	1.34	21.1	8.89	1897
1898..	72, 947, 000	28.43	25.15	14.08	.47	5.56	6.07	2.02	.88	.44	2.34	2.17	8.05	1.99	48.80	24.77	4.78	1.22	1.39	21.6	9.01	1898
1899..	74, 318, 000	29.47	25.58	15.55	.54	6.94	8.14	1.88	.96	.44	3.68	1.59	9.22	2.72	52.07	29.48	3.57	1.28	1.41	21.9	9.13	1899
1900..	76, 303, 387	30.66	26.94	14.52	.44	7.43	6.39	1.85	1.04	.47	3.87	1.51	10.88	3.01	49.24	27.62	3.20	1.34	1.46	21.4	10.04	1900
1901..	77, 647, 000	31.98	27 98	13.45	.38	7.56	6.56	1.79	1.01	.43	3.96	1.43	10.58	3.01	49.64	28.91	3.23	1.44	1.52	22.0	10.35	1901
1902..	79, 003, 000	32.45	28.43	12.27	.35	7.11	5.96	1.75	1.01	.37	3.44	1.60	11.39	3.17	49.78	27.95	3.13	1.54	1.59	22.3	10.69	1902
1903..	80, 372, 000	33.40	29.42	11.51	.32	6.93	6.26	1.72	.92	.36	2.87	1.94	12.54	3.48	49.03	27.85	2.98	1.67	1.73	22.7	11.11	1903
1904..	81, 752, 000	34.29	30.77	11.83	.30	6.60	7.11	1.74	.98	.41	2.85	1.94	12.01	3.16	48.78	26.30	3.32	1.76	1.86	23.0	11.86	1904
1905..	83, 143, 000	34.68	31.08	11.91	.29	6.54	6.81	1.72	1.06	.41	2.82	1.85	13.08	3.11	45.24	23.77	3.48	1.84	2.05	23.4	12.46	1905
1906..	84, 154, 009	36.48	32.32	11.46	.28	7.02	6.72	1.68	1.14	.45	2.96	1.76	14.42	3.49	44.16	24.22	3.00	2.00	2.17	.....	.....	1906

Year.	Exports of domestic merchandise.						Retained for consumption per capita.									Raw wool retained for consumption.		Tonnage of vessels. Annual increase or decrease (+ or −).	Imports and exports of merchandise by sea carried in American vessels.	Year.
	Total exports per capita.	Exports of products of manufacture, per cent of total exports.	Per cent of product exported.				Raw cotton.	Wheat and wheat flour.	Corn and corn meal.	Sugar.	Coffee.	Tea.	Distilled spirits.	Malt liquors.	Wines.	Total per capita.	Foreign.			
			Cotton.	Wheat and wheat flour.	Corn and corn meal.	Bituminous coal.														
	Dollars.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Pounds.*	*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pf. galls.*	*Gallons.*	*Gallon.*	*Pounds.*	*Per cent.*	*Per cent.*	*Per cent.*	
1871..	10.83	20.86	72.39	22.30	0.98	0.86	14.10	4.69	27.40	36.2	7.91	1.14	1.62	6.10	0.40	5.73	29.4	+ 0.85	31.9	1871
1872..	10.55	20.16	67.44	16.88	3.60	.58	11.10	4.79	21.09	40.4	7.28	1.46	1.68	6.66	.41	6.75	45.3	+ 3.62	29.2	1872
1873..	12.12	20.01	65.47	20.80	3.68	1.00	15.19	4.81	22.86	39.8	6.87	1.53	1.63	7.21	.45	5.67	33.2	+ 5.82	26.4	1873
1874..	13.31	18.81	70.03	32.54	3.86	1.29	13.60	4.46	20.95	41.5	6.59	1.27	1.51	7.00	.48	4.81	17.5	+ 2.23	27.2	1874
1875..	11.36	20.42	70.69	23.60	3.53	.82	11.90	5.38	18.66	43.6	7.08	1.44	1.50	6.71	.45	5.28	22.1	+ 1.10	26.2	1875
1876..	11.64	20.14	70.75	25.34	3.86	.86	14.77	4.89	28.14	35.2	7.33	1.35	1.33	6.83	.45	5.21	18.3	−11.83	27.7	1876
1877..	12.72	24.45	68.97	19.73	5.66	1.18	14.03	5.01	26.13	38.9	6.94	1.23	1.28	6.58	.47	5.16	16.3	− .86	26.9	1877
1878..	14.30	20.45	71.23	25.29	6.49	1.10	13.71	5.72	26.37	34.3	6.24	1.33	1.09	6.68	.47	5.28	16.9	− .70	26.3	1878
1879..	14.29	19.10	67.74	35.16	6.33	.85	15.90	5.58	26.61	40.7	7.42	1.21	1.11	7.05	.50	5.03	14.2	− 1.02	23.0	1879
1880..	16.43	14.78	65.73	40.18	6.43	.66	18.94	5.35	28.88	42.9	8.78	1.39	1.27	8.26	.56	6.11	34.9	− 2.43	17.4	1880
1881..	17.23	15.30	68.47	37.38	5.46	.50	19.64	6.09	31.64	44.2	8.25	1.54	1.38	8.65	.47	5.66	17.3	− .25	16.5	1881
1882..	13.97	22.09	67.23	31.82	3.71	.65	16.15	4.98	21.92	48.4	8.30	1.47	1.40	10.03	.49	6.36	19.0	+ 2.66	15.8	1882
1883..	14.98	19.95	67.20	29.33	2.58	.76	20.80	6.64	29.24	51.1	8.91	1.30	1.46	10.27	.48	6.62	18.7	+ 1.67	16.0	1883
1884..	13.20	21.51	67.56	26.49	2.99	.89	16.30	5.64	27.40	53.4	9.26	1.09	1.48	10.74	.37	6.85	20.6	+ .84	17.2	1884
1885..	12.94	20.67	68.96	25.86	2.95	.92	15.16	6.77	31.04	51.8	9.60	1.18	1.27	10.62	.39	6.69	18.0	− .12	15.3	1885
1886..	11.60	21.87	64.68	26.48	3.35	.82	19.59	4.57	32.60	56.9	9.36	1.37	1.28	11.20	.45	7.39	28.9	− 3.16	15.5	1886
1887..	11.98	21.21	68.71	33.66	2.48	.97	16.84	5.17	27.68	52.7	8.53	1.49	1.21	12.23	.55	6.68	27.4	− 60	14.3	1887
1888..	11.40	22.53	65.83	26.23	1.74	.99	19.59	5.62	23.86	56.7	6.81	1.40	1.26	12.80	.61	6.31	28.9	+ 2.10	14.0	1888
1889..	11.92	22.72	69.33	21.31	3.57	.92	17.22	5.34	31.28	51.8	9.16	1.29	1.32	12.72	.56	6.33	31.8	+ 2.74	14.3	1889
1890..	13.50	21.18	68.15	22.31	4.85	1.33	18.50	6.09	32.09	52.8	7.83	1.33	1.40	13.66	.46	6.03	27.0	+ 2.71	12.9	1890
1891..	13.66	21.58	67.36	26.60	2.15	1.48	22.38	4.59	22.84	66.3	8.00	1.29	1.43	15.31	.46	6.44	30.8	+ 5.88	12.5	1891
1892..	15.61	18.02	65.13	36.88	3.72	1.62	24.58	5.94	30.48	63.8	9.67	1.38	1.49	15.17	.43	6.75	33.1	+ 1.71	12.3	1892
1893..	12.98	21.57	65.99	37.20	2.89	1.57	17.84	4.89	23.83	64.4	8.31	1.32	1.52	16.20	.48	7.10	35.7	+ 1.26	12.2	1893
1894..	12.85	23.33	71.20	41.47	4.11	1.90	16.45	3.44	22.96	66.7	8.30	1.36	1.34	15.32	.32	5.13	14.2	− 2.90	13.3	1894
1895..	11.51	25.84	69.83	31.46	2.36	2.24	22.75	4.59	17.18	63.4	9.33	1.40	1.14	15.13	.30	7.39	40.0	− 1.03	11.7	1895
1896..	12.29	29.89	65.00	27.07	4.70	1.86	18.67	4.85	29.18	62.5	8.11	1.33	1.01	15.84	.27	6.98	45.9	+ 1.47	12.0	1896
1897..	14.42	30.15	70.59	33.93	7.83	1.94	18.77	3.95	23.40	64.8	10.12	1.58	1.02	14.94	.53	8.40	57.8	+ 1.38	11.0	1897
1898..	16.59	26.81	67.82	40.91	11.14	2.04	25.76	4.29	23.19	61.5	11.68	.93	1.12	15.96	.28	5.44	32.8	− .40	9.3	1898
1899..	16.20	31.59	65.12	32.97	9.21	2.34	27.87	6.09	23.51	62.6	10.79	.98	1.18	15.28	.35	4.51	19.2	+ 2.41	8.9	1899
1900..	17.96	35.30	65.18	34.00	10.30	3.14	22.57	4.74	24.44	65.2	9.81	1.06	1.25	16.01	.39	5.72	34.4	+ 6.18	9.3	1900
1901..	18.81	31.88	62.87	41.36	8.62	3.04	25.94	3.95	24.77	68.7	10.48	1.14	1.31	16.20	.37	5.18	24.9	+ 6.96	8.2	1901
1902..	17.16	33.48	64.47	31.37	1 84	2.68	25.65	6.50	18.92	72.8	13.42	.94	1.36	17.49	.63	6.07	34.1	+ 4.95	8.8	1902
1903..	17.32	33.61	65.01	30.28	3.04	2.24	24.64	5.81	30.45	71.1	10.91	1.30	1.46	18.04	.48	5.74	37.8	+ 4.99	9.6	1903
1904..	17.56	36.47	60.27	18.92	2.59	2.55	25.28	6.33	26.74	75.3	11.83	1.34	1.48	18.28	.53	5.66	37.0	+ 3.35	10.3	1904
1905..	17.94	40.96	61.55	7.99	3.66	2.69	33.07	6.15	28.59	70.5	12.17	1.23	1.45	18.50	.42	6.52	45.5	+ 2.62	12.1	1905
1906..	20.41	39.93	62.69	14.09	4.43	2.54	26.51	7.08	30.75	76.1	9.95	1.10	1.51	20.20	.55	5.88	39.6	+ 3.38	12.0	1906

USEFUL FACTS ABOUT THE COUNTRIES OF THE WORLD

ONE of the most useful annual volumes issued by the government is the "Statistical Abstract of the United States," which is published by the U. S. Bureau of Statistics. The volume for 1906, prepared by Hon. O. P. Austin, Chief of the Bureau, has just been distributed and is aptly described as a series of panoramic views of conditions in the United States from 1800 to the present time in area, population, production, commerce, circulation, wealth, intercommunication, publication, and education. The 700 pages of solid figures supply much more of actual information, both historical and as to the present conditions, than could be placed in any other form in equivalent space.

All kinds of puzzling questions will here find an answer. For instance, if the manufacturer of boots and shoes wants to know the countries in which American boots and shoes are being sold, and those in which the gains are most rapid, he will obtain the information from the abstract. Similarly, any merchant who desires to know the quantity and value imported or exported of any given article or class of articles in which he deals, may find not only the values of the imports or exports of the article in question, but the countries from which imported or to which exported and the growth in trade with that country year by year.

The American citizen who wants to know the sources from which the large and rapidly growing revenues of the Government are drawn and the purposes for which they are expended, here finds the detailed statement.

Through the courtesy of Mr Austin several tables showing the material progress of our country since 1870 are republished on the preceding pages.

The wealth of the United States, which in 1850 was set down at 7 billions of dollars, is given at 107 billions in 1904, the latest year for which figures are available; and the per capita wealth, which in 1850 was $307, was in 1904 $1,310. The public debt, which in 1864 was 2,675 million dollars, is now but 964 millions, and the per capita indebtedness which in 1864 was $76.98 is now but $11.46; while the annual interest charge, which was then $4.12 per capita, is now but 28 cents per capita. The money in circulation, which in 1800 was 26 million dollars, in 1850 278 millions, and in 1880 973 millions, was in 1906 2,736 millions; and the per capita circulation, which in 1800 was $5, and in 1850 $12, was in 1906 $32.32.

Bank deposits, for which no record is available earlier than in 1875, were in that year a trifle over 2 billion dollars, in 1900 7¼ billions, and in 1906 12¼ billions. Deposits in savings banks in 1820 amounted to 1 million dollars, speaking in round terms; in 1850 they had reached 43 millions, in 1875 924 millions, in 1900 2 1/3 billions, and in 1906 3¼ billions; while the number of depositors, which in 1820 was only 8,635, in 1850 251,354, in 1875 2,359,864, and in 1900 6,107,083, was in 1906 8,027,192, or nearly a thousand times as many as in 1820, while the deposits were more than 3,000 times as much in 1906 as in 1820.

Imports of merchandise, which in 1800 amounted to 91 million dollars, were in 1906 1,226 millions; while exports, which in 1800 were 71 millions, were in 1906 1,744 millions. The per capita of importations, which in 1800 amounted to $17.19, was in 1906 but $14.42, while the per capita of exportations, which in 1800 was $13.37, was in 1906 $20.41.

In the great manufacturing industries evidences of progress are equally apparent. The page devoted to this subject shows that the number of people employed in manufacturing has grown from

less than 1 million in 1850 to 5½ millions in 1905; the wages paid, from 237 million dollars in 1850 to 2,611 millions in 1905; and the value of products, from 1 billion dollars in 1850 to nearly 15 billions in 1905.

No nation in the history of the world has a record comparable with this.

FOUR PROMINENT GEOGRAPHERS

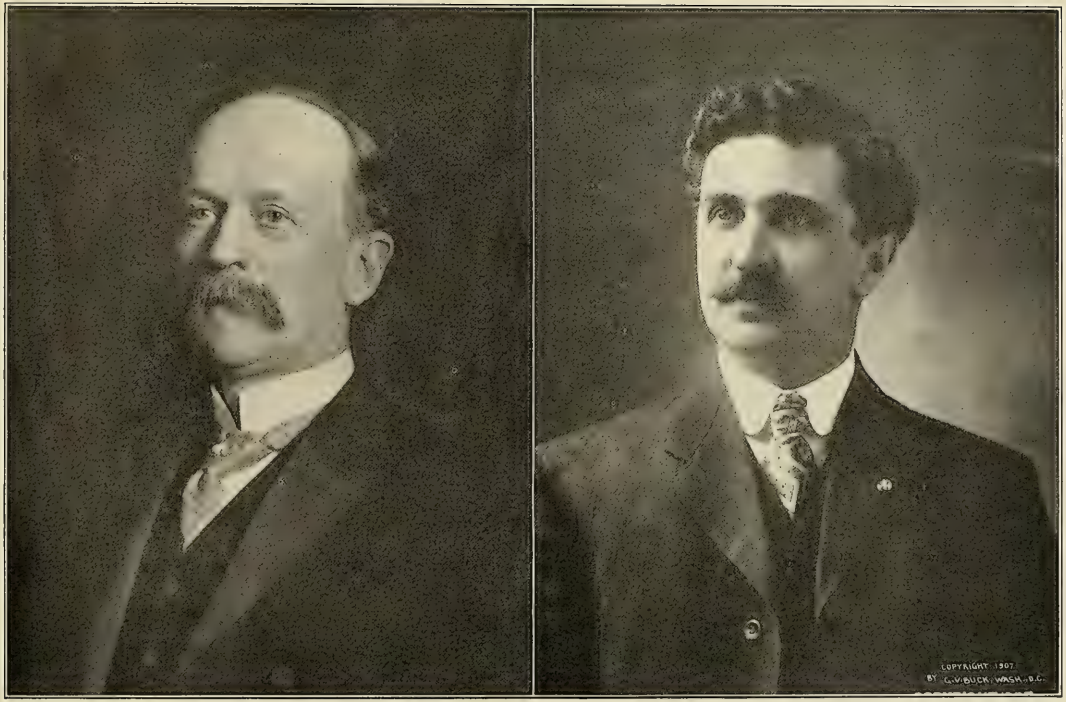
THE recent changes and promotions in the U. S. Geological Survey mark the close of one period and the entrance upon a new phase of existence. By the election of Mr Charles D. Walcott as Secretary of the Smithsonian Institution the former Director of the Geological Survey was promoted to the highest scientific position in the city of Washington. By the retirement of Mr Walcott from the directorship, the Geological Survey and the Reclamation Service lost their long-time leader, and these two organizations, connected through the individuality of Mr Walcott, were definitely separated. The change was made quietly and as a matter of evolution, Mr F. H. Newell, chief engineer of the Reclamation Service, becoming the Director of the organization, being succeeded by Mr Arthur P. Davis, who now is chief engineer.

The directorship of the Geological Survey has been filled by the designation of Mr George Otis Smith, one of the younger geologists, who has shown unusual ability, not only in scientific work, but in the tactful handling of business affairs.

Mr Smith was born in 1871 in Maine, and is a graduate of Colby College and of Johns Hopkins University, from which he received the degree of Ph. D. in 1896. During his connection with the U. S. Geological Survey as a geologist for the past ten years, he has worked in Michigan, Washington, Utah, North Carolina, the New England States, New Jersey, and Pennsylvania. He is the author of several geologic folios and monographs published by the Survey and of numerous contributions to technical journals. His work has been typical of the object for which the U. S. Geological Survey is maintained, namely, the application of the highest scientific training to obtain results of practical value to the public.

The history of the growth of the Reclamation Service from the Geological Survey is an illustration of the development of scientific investigation into practical operation. In the early eighties Major John W. Powell agitated the question of a thorough scientific investigation of the water resources of the West, and in 1888 he, as Director of the Geological Survey, was authorized by Congress to investigate the extent to which the arid region might be reclaimed by irrigation. This work was carried on systematically, under his direction, through the topographic and hydrographic surveys of the Geological Survey.

Upon the retirement of Major Powell and the succession of Mr Walcott, this work was continued with renewed vigor, and a large amount of information was collected as to the reservoir sites, the catchment areas of streams, and the amount of water which would be available for use at various points. As a result largely of this careful scientific investigation, Congress in 1902 took up and passed the so-called Newlands bill, setting aside the proceeds from the disposal of public lands to the construction of works of reclamation. The work was put in charge of the Secretary of the Interior, who naturally turned it over to the Director of the Geological Survey. He in turn intrusted it to the men who had been making scientific examination and studies through many years. They con-



Charles D. Walcott

Secretary Smithsonian Institution. For thirteen years the Director of the U. S. Geological Survey

George Otis Smith

The new Director of the U. S. Geological Survey

The U. S. Geological Survey is the largest and most practical map-making institution in the world

Frederick Haynes Newell

Director of the U. S. Reclamation Service

Arthur P. Davis

Chief Engineer of the U. S. Reclamation Service

The United States government, through its Reclamation Service, is investing $12,000,000 annually in reclaming arid land, thereby creating the greatest irrigating works in the history of the world

tinued these studies, and out of them developed definite plans for the construction of large works, and began the building of these with the funds furnished through the terms of the reclamation act. There thus took place from 1902 a rapid change in character of the work, and the researches of the Geological Survey became almost overshadowed by the great operations of the Reclamation Service. The latter was at no time connected with the Geological Survey, as such, but from the fact that the Director of the Geological Survey was also the Director of the Reclamation Service, the two bodies have frequently been confused. The Reclamation Service was an offshoot or development of the Hydrographic Branch of the Geological Survey, the principal men of that branch, Mr Newell and Mr Davis, becoming the leaders in the Reclamation Service.

With the retirement of Mr Walcott from the directorship, the connection, which had been growing less and less, was finally terminated on March 9, 1907, by the designation of Mr Newell as Director. With the experience gained through nearly five years, the Reclamation Service is now in a condition to stand alone.

The period of survey and examination of the Reclamation Service has already passed and the principal efforts are being devoted to the construction of great works. The third period of its existence—that of operation and maintenance—has already been entered upon, and water is being diverted during 1907 to about 200,000 acres of agricultural land scattered throughout the western part of the United States. The expenditures have been made at the rate of one million and a half dollars per month, and in this regard the Reclamation Service has reached and passed the period of maximum activity. Henceforth the expenditures will decline somewhat, and it is expected that during 1907 the total expenditure will be about $12,000,000, and in 1908 about $7,000,000; so that by 1909 about $40,000,000, in round numbers, will have been invested in revenue-producing works.

The engineering features of the Reclamation Service have been placed under the charge of Mr Arthur P. Davis, who was for many years the assistant chief engineer and principal field man in direct contact with all of the engineering features. The Director, Mr Newell, will give his personal attention to matters of general policy, cost of the works, and especially to the problems of operation and maintenance. Upon this latter depends the future success of the reclamation act, as it is essential to obtain from the completed works the cost of construction and to invest it again in other large projects.

NOTES

AT a recent meeting of the Council of the Geographical Society of Paris, Mr Henry Gannett, Vice-President of the National Geographic Society and Chief Geographer of the United States Geological Survey, was unanimously elected an honorary corresponding member. The Geographical Society of Paris was founded in 1821 and is the oldest geographical organization in the world It has fifteen honorary corresponding members, among whom are included Dr Nansen, Sir John Murray, Prof. Albrecht Penck, and three Americans, Major General A. W. Greely, U. S. Army; Commander Robert E. Peary, U. S. Navy, and Prof. William M. Davis, of Harvard University.

The July number of the NATIONAL GEOGRAPHIC MAGAZINE will contain a map of the North Polar regions in seven colors, 18 x 18 inches, prepared by the Editor, Gilbert H. Grosvenor. The map will show all discoveries to date and will contain inserts of the Smith Sound region, of Franz Josef Land, and of Spitzbergen. The number will also contain several articles summarizing recent explorations in the Far North.

The NATIONAL GEOGRAPHIC MAGAZINE

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Supplement to the National Geographic Magazine, July 1907, Washington, D. C.

The National Geographic Magazine Map of

THE NORTH POLE REGIONS

Prepared by

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THE NATIONAL GEOGRAPHIC MAGAZINE

SOME RECENT INSTANCES OF NATIONAL ALTRUISM*

The Efforts of the United States to Aid the Peoples of Cuba, Porto Rico and the Philippines

By Hon. William H. Taft
Secretary of War

I ASK your attention today to the page of the nation's history covering the last nine years, with the hope of showing that there never has been on the part of any country a greater exhibition of pure altruism than that exhibited by the United States from the beginning of the Spanish War down to the present day, toward the peoples who were immediately affected.

As we read the history of a man or a nation, that which excites our admiration is courageous action for which no motive can be found save that of a desire to discharge a duty to mankind. A study of the conduct of our nation with respect to Cuba, Porto Rico, and the Philippines, covering now nearly a decade, ought to fill every American with pride. I do not mean to say that there were not Americans who entered upon the war or favored the Cuban or the Philippine policy from motives of selfishness, and with a hope of increasing our trade and enlarging our dominion from the mere love of exploitation and empire, but the great body of the people went into and fought out the Cuban war, assumed the burden of the temporary government of Cuba, and the more or less permanent government of Porto Rico, fought out the Philippine wars and assumed the government of the Philippines all from a sense of duty only, and that most reluctantly, because they could not foresee the extent of the burdens which we were taking up.

It is hardly necessary for me to recall the resistance that President McKinley, in 1898, offered to the popular movement, that carried him slowly but surely to the point of an open conflict with Spain. That which the American people believed to be the oppression of the Cuban people, the misgovernment of that beautiful island, and the continued failure of Spain to restore any kind of order—all compelled the United States to interfere to prevent a continuance of that which

*An address to the Miller's Convention in Saint Louis, Mo., May 30, 1907.

seemed to our people to be an international scandal at the doors of this country; and as we went into it, in order that we might free ourselves from the charge of land-grabbing or spirit of conquest, we made the declaration that we would not retain Cuba, but would make her an independent republic as soon as circumstances would permit. The wisdom of this self-denying declaration has often been questioned, and I am not prepared myself to say that it was the wiser course to pursue. So far as our country was concerned, it was. But recent events give rise to a doubt whether, in our anxiety to make clear our own unselfish motive, we may not have committed ourselves to a policy not best adapted to the welfare of the Cubans. However that may be, it is certain that when it was adopted, it was adopted in what was thought to be the best interests of Cuba, and what was known to be in accordance with the unselfish desire of the American people to help their oppressed neighbors.

It is true that the presence of yellow fever in Havana had threatened the health of this country in its southern ports, and that the failure of Spain to remove this persisting danger has been frequently cited to justify on international grounds the declaration of war; but we all of us know that the real ground for the war was the sympathy that the Americans had with a people struggling against an oppressive and misguided rule in a contest carried over many years and which had laid waste one of the most beautiful islands of the world. This was what led us on, and he who says that it was not true altruism does not understand either the American people or the motives which guide them.

$300,000,000 EXPENDED AND NOT A CENT DEMANDED IN RETURN

We expended in the Cuban war upwards of $300,000,000, and we never have invited from Cuba the return of a single cent. We offered up in deaths and wounds and disease in that war the lives of 148 officers and over 4,100 enlisted men. We paid $20,000,000 to Spain under the treaty of peace. The exact consideration for this sum it may be difficult to state, but the result of the payment was the treaty, and by that treaty was secured a cession of Cuba and Porto Rico and the Philippines freed from the debts which Spain had incurred in their maintenance. It is not too much to say, therefore, that by this payment the United States freed the islands from a heavy burden of debt which, under ordinary conditions of a transfer, might have followed them under American sovereignty.

When the Spanish army left Cuba, the country had long had but little governmental control, except that exercised in the immediate neighborhood of the troops who were about departing. The ordinary social restraints had been destroyed, the cities were crowded with thousands of refugees and reconcentrados who were exasperated by suffering and the death of their families and friends, and it was deemed necessary to take especial precautions for the prevention of riot and bloodshed. The officers of the United States Army in Cuba were at once occupied in instituting, under the direction of the military governor and the department commanders, a general civil administration for which no other governmental machinery existed and in aiding the existing municipal governments in the performance of their duties. It was necessary to furnish immediate relief for the prevailing distress among the starving reconcentrados. Five million four hundred and ninety-three thousand rations, at a cost of $1,500,000 to the United States, were issued to distressed persons through the agency of the officers of the army.

The condition of the soldiers of the Cuban army, who had been separated from any productive industry and who upon the conclusion of hostilities were left substantially without homes or occupation and with no pay coming to them from any source, required that some relief should be afforded which would en-

able them to disband and return to peaceful employment. To facilitate this, $75 apiece was paid to each Cuban soldier on his bringing in and depositing his arms. In this way $2,550,000 were paid out of the United States Treasury, and upon the payment being completed, the Cuban army separated and ceased to exist.

NUMBER OF PUPILS AT SCHOOL INCREASED 500 PER CENT IN 5 YEARS

The subject of sanitation of the island, from one end to the other, and especially in the towns left in a filthy condition, was taken up with the thoroughness of the army surgeons, and in the course of this effort one of the greatest and most useful discoveries known to medical science, to wit, the transmission of disease by the mosquitoes, was added to the sum of human knowledge. For four years this sanitation went on, and under American occupation the amount expended for this out of the Cuban treasury reached the large sum of $10,000,000.

Cuba, an island 44,000 square miles in area, with a population of 1,600,000, had enrolled in her public schools under Spanish control 36,306 pupils. There were practically no separate school buildings. The pupils were collected in the residences of the teachers. There were few books, and no maps, blackboards, desks, or other school apparatus. The teaching was of the most primitive character and was carried on under a fee system which excluded altogether the children of the poor. At the end of the first six months of American occupation the public school enrollment of the island numbered 143,000, and this was increasing until the island was turned over, in May, 1903, when it had reached 200,000.

The prisons, the squalor and misery of which it is hard to exaggerate, were thoroughly cleansed and put upon the basis of modern requirements.

The controversy between the church and the government over church property was settled by arbitration, and an agreement satisfactory to both sides was reached.

The restoration of industry in the island was necessarily slow, but in this regard especially did the government and the people of the United States show their earnest desire to aid by a generous policy the people for whose freedom they had spent so much money and so many lives. In pleading for a reduction of duty upon Cuban tobacco and sugar, President Roosevelt said to Congress:

"We are a wealthy and powerful nation; Cuba is a young republic, still weak, who owes to us her birth, whose whole future, whose very life, must depend on our attitude toward her. I ask that we help her as she struggles upward along the painful and difficult road of self-governing independence. I ask this aid for her because she is weak, because she needs it, because we have already aided her. I ask that open-handed help, of a kind which a self-respecting people can accept, be given to Cuba, for the very reason that we have given her such help in the past. Our soldiers fought to give her freedom; and for three years our representatives, civil and military, have toiled unceasingly, facing disease of a peculiarly sinister and fatal type with patient and uncomplaining fortitude, to teach her how to use aright her new freedom. Never in history has any alien country been thus administered with such high integrity of purpose, such wise judgment, and such single-minded devotion to the country's interests. Now I ask that the Cubans be given all possible chance to use to the best advantage the freedom of which Americans have such right to be proud and for which so many American lives have been sacrificed."

In accordance with this recommendation, a treaty was made between the United States and the Republic of Cuba, whereby provision was made that products of Cuba coming into the United States should receive the benefit of reductions in the tariff ranging from 20 to 40 per cent of the regular duties on such products. Under the beneficent influence of this favorable discrimination in tariff rates, the prosperity of Cuba increased,

so that this year, in spite of an insurrection, to which I shall hereafter refer, she will export 1,200,000 tons of sugar, the largest in her history, and as large a tobacco crop in matter of value as she ever has produced. It should be said, however, that the drouth of this year has interfered with sugar planting for future crops, and that it has much injured the food crops. The actual loss in revenue to the United States from the reduction of tariff rates by the treaty is certainly not less than $10,000,000 a year.

AMERICAN INTERVENTION IN 1906

In May, 1903, the United States turned over to the Republic the control of Cuba. During the intervention there had been held elections for municipal officers, and also for the members of a constitutional convention. At the instance of the United States, there was introduced into the constitution what was known as the "Platt amendment," by which the United States was given the right to intervene at any time in order to maintain in Cuba a government of law and order. We thus secured the right to act in support of the government which we had paid out so much money and so much blood to establish. For three years and a half the Republic of Cuba maintained itself with great apparent prosperity, but an abuse by the party in control of its executive power in respect to elections brought on an insurrection, which the government of the Republic had not properly prepared itself to resist or suppress, and the island was soon in the throes of a war which bade fair to destroy for several years its agricultural wealth, and to bring about again that awful condition which insurrections against Spain had produced. Again the United States intervened; sent first a formidable fleet, and then an army of 5,000 men, secured a disbandment of the opposing forces, and established a provisional government. This it did under a proclamation which promised a restoration of the Republic, as soon as tranquillity was restored to such an extent as to permit the holding of a fair election and the determination of those persons upon whom a government could be properly devolved.

The Republic had not complied with its constitution in several important respects—it had not made provision for an independent judiciary; it had not provided autonomy in its municipalities, and it had not provided an election law which would secure, as required by the constitution, minority representation. A commission under the provisional government is now drafting an election law, including a law for an electoral census, a law making the judiciary independent, a civil-service law, and a law establishing autonomy in municipalities. It is to be hoped that within seven months we may take an electoral census; then hold a municipal election, and six months thereafter a national election; and then, after a further interval of four months, turn over the government to the persons properly elected.

In this intervention the United States has already spent about $4,000,000 and will be put to a possible additional expense of perhaps $3,000,000 more. The President is given authority to receive from the Cuban treasury such sums as the condition of that treasury may permit, to reimburse the United States for the expense of intervention, but it is quite unlikely that, in the various calls that there are upon the Cuban treasury for works of improvement and for the bettering of the government, any large part of these funds thus expended will be reimbursed to the United States.

PORTO RICO

The sovereignty of the Island of Porto Rico passed to the United States on the 18th of October, 1898, and this with the full consent of the people of that island. On May 1, 1900, the military government ceased and a civil government, in accordance with the act of Congress, was inaugurated, and this continues unchanged down to the present. It includes a governor appointed by the President, an executive council appointed by the

President, and an elective national assembly. The legislature is made up of the two houses of the assembly and the executive council. Of the civil servants in the central government, 343 are Americans and 2,548 are natives.

Very early in the American history of the island a cyclone passed over it, destroying a large part of its coffee culture; $200,000 was expended from the emergency fund of the United States Treasury to buy rations for those left in distress. Under the law all the customs are turned into the treasury of Porto Rico for the maintenance of the island government, while the United States pays the cost of the army, the navy, the lighthouse service, the coast surveys, the harbor improvements, the marine hospital support, the post-office deficit, the weather bureau, and the upkeep of the agricultural experiment stations. Under the last normal year of Spanish rule there was a total revenue of $3,664,000 and a total expenditure of $2,869,000, including the central, provincial, and municipal receipts and expenditures. For the year 1906 the total revenue, provincial and municipal, was $4,250,000 and the expenditure $4,054,000.

There is maintained in the island a Porto Rican regiment, paid by the United States, and in addition a constabulary or rural police, maintained at the expense of the island treasury. The island is policed by 700 men, and complete tranquillity reigns. Under the Spanish régime, there was in the island a force of over a thousand rural guards, beside a thousand municipal and urban police, and in addition the regular Spanish army of 4,000 men and several regiments of militia. Ladronism was by no means rare.

THE ENROLLMENT OF PUPILS HAS INCREASED 600 PER CENT IN 8 YEARS

Down to the last day of Spanish rule, there was not in this island, containing a million people, a single building constructed for or dedicated to public instruction, and the enrollment of pupils was but 21,000. There are today in this island 97 such buildings, and the enrollment of pupils has reached the number of 130,000. In the last year of Spanish rule there was expended $35,000 in gold for public education. Under the present government, there is expended a total of $854,000 each year.

When the Spanish domination ended, there were 172 miles of macadamized road. Since the United States took control, there have been constructed 291 miles more, making in all now a total of 463 miles of finely planned and admirably constructed macadamized roads—as fine roads as there are in the world.

In the course of the administration of this island, the medical authorities of the government discovered a disease of anæmia which was epidemic and was produced by a microbe called the "hook worm." It so much impaired the energy of those who suffered from it, and so often led to complete prostration and death, that it became necessary to undertake its cure by widespread governmental effort. I am glad to say that the effect of the government's treatment has been much to reduce the extent and severity of the disease, and that it has been brought under control.

There is complete free trade between Porto Rico and the United States, and all customs duties collected in the United States on Porto Rican products subsequent to the date of Spanish evacuation, amounting to nearly $3,000,000, have been refunded to the island treasury. The loss to the revenues of the United States from the free admission of Porto Rican products is $15,000,000 annually. In the making of tobacco into cigars and cigarettes and of cane into sugar, a considerable number of the laboring class find mechanical employment, but the wealth of the island is directly dependent upon the cultivation of the soil, to cane, tobacco, coffee, and fruit, for which we in America provide the market. Without our fostering benevolence, this island would be as unhappy and prostrate as are some of the neighboring British,

French, Dutch, and Danish islands. During the last two years of Spanish domination the trade balance against the island was over $12,500,000, while the present balance of trade in favor of the island under American control is $2,500,000. The total of exports and imports has increased from about $25,000,000 under Spain to $44,000,000 under our sovereignty. At the date of the American occupation the estimated value of all agricultural land was about $30,000,000. Now the appraised value of the real property in the island reaches $100,000,000.

PHILIPPINES

The fortune or misfortune of the Cuban war carried us to the Philippines. The exigencies of the situation brought us into such relations with Aguinaldo and the Filipino troops in insurrection against Spain, that when peace came we could not turn the islands back to Spain. Our international obligations and the welfare of the people of the country prevented us from turning the government over to the military forces commanded by Aguinaldo. His attempt to carry on a government had been a failure. The failure would have been colossal, had he been given more responsibility. The only alternative was for us to take over the island ourselves and administer the government until by gradual training in partial self-government the people might become so acquainted with the art and responsibilities of government that we could ultimately leave the islands.

Accordingly we undertook, first, the establishment of order in the islands, and then the maintenance of civil government. In the course of this we had first to disperse Aguinaldo's army and then to suppress the guerrilla warfare which the country was well adapted to encourage and facilitate. In establishing order we expended $170,000,000. As order was established from place to place, municipal governments were set going with complete autonomy. Provincial governments were established with a governing board of three, in which two of the officers were appointed and one, the governor, was elected. A central government was established, with a civil governor appointed by the President and eight commissioners, five of them executive officers and American and three of them Filipinos. By changes effected in the period of six years, a majority of the provincial officers have become elective, and only one, the provincial treasurer, is appointed under the civil-service law. In July next an election will take place by which an assembly of seventy representatives, elected by the qualified voters of the Christian provinces, will constitute a national assembly, which will be one of the two houses, the other being the Philippine Commission, to constitute the legislature of the islands. The national assembly elected in July will meet for the first time in October. Thus has the promise of our government, made through President McKinley, been kept, of gradually increasing the measure of self-government extended to the Filipinos.

AMERICAN IMPROVEMENTS IN THE PHILIPPINES

Having established order by use of the military, a Philippine constabulary was created, consisting of some 5,000 men, who police the islands. Considering that the islands contain a population of now more than 7,000,000, this constabulary force is not excessive. The American troops in the islands number about 12,000. There is also a Philippine military force, known as the Philippine scouts, 4,000 in number, that are really enlisted men of the United States Army. The expenses of the United States in the islands from year to year are about $5,000,000 in the support of the army over and above what would be expended were there no Philippine scouts and were the army housed in the United States.

During the threat of famine in 1902 and 1903, arising from the death of most of the draft cattle of the islands, due to rinderpest, Congress voted $3,000,000 to

be expended for the purpose of relieving suffering.

As soon as the Americans reached the islands, even while war was flagrant, schools were established, and now there are reading, writing, and reciting in English in the Philippine Islands one-half million of children daily. The unfortunate conditions under which the use of some seven or eight different languages in different islands and different parts of the same island prevented a common medium of communication is gradually to be remedied. More people speak English than Spanish now, and in a generation the language of the islands will be English, unless the present policy is changed. Industrial and secondary schools are being established in every province, and the Philippine child by manual training is being taught the dignity of labor, though in his father's time it had always been regarded as a badge of humiliation.

We have secured the construction of a street-car system in the city of Manila thirty-five miles in length, which greatly relieves the expense of living in that city, arising from the necessary use of cabs in the absence of a street railway. We are constructing great waterworks and a comprehensive sewer system for Manila. We have constructed costly harbor works at three great ports of the islands—Manila, Iloilo, and Cebu. We have added many hundred miles to the road mileage of the islands, and have now contracts for the construction of railways, so that within a few years, under contracts now in force, the mileage of the railways will have been increased to near a thousand miles, though it was but 124 when we entered the islands. We have carried the islands through epidemics of plague and of cholera and have stamped them out. Just as we entered the islands, 75 per cent of the cattle were destroyed by rinderpest. We have discovered a method for suppressing the rinderpest which we have an efficient force of civil servants to apply, so that hereafter there is no danger that the islands will be again denuded of cattle from this cause.

We have introduced a judiciary system which commands the confidence of all; it is partly American, partly native. We have abolished the Spanish code of civil procedure, which was adapted to keep litigants in the vestibule of the courthouse forever, and have substituted a plain, practical American code.

We have purchased from the religious orders 400,000 acres of the best land in the islands, the ownership of which by them put them in a relation of hostility to 60,000 tenants, who refused to recognize their title or pay rent. Had they gone into court and sought evictions, another insurrection would have followed. The government has now purchased these lands for $7,000,000 and is engaged successfully in selling them out to the tenants on easy terms, so that in less than a decade they will become the owners of the lands.

A currency of a Philippine silver peso, maintained by law at 50 cents gold, has been substituted for the old, varying Mexican dollar. In other words, we have established there the gold standard.

We have suppressed ladronism and disorder throughout the islands, so that agriculture is now being pursued in a greater degree than ever before since the insurrection of 1896.

Business has been depressed, but is gradually recovering. The total of imports and exports has increased from $36,000,000, annual average from 1890-1894, to an annual average of $60,000,000 during the last four years.

The Congress of the United States has discriminated in favor of the islands to the extent of permitting its products to be introduced into the United States at 25 per cent reduction on the Dingley rates. It has been proposed to increase this reduction, so as to make it 75 per cent on the Dingley rates, and ultimately, in 1909, to take off the duty altogether on the products of the Philippine Islands. Such a bill passed the House of Representatives, was not voted on in the Senate, but

was strangled in committee. In the history of this bill for the first time is heard a note of selfishness in the policy of the United States toward any of her Spanish dependencies.

The sugar and tobacco interests of the country are afraid that the introduction of the Philippine products may affect them. Nothing could be further from the truth. We import now 1,200,000 tons of sugar, which comes over the tariff wall, having paid the full tariff rates, or at least only 20 per cent less. The total exportation of sugar from the Philippines in the last three or four years has not exceeded 100,000 tons. It never in the history of the islands exceeded 265,000 tons. The introduction, therefore, of Philippine sugar into the United States, assuming that it might rise to 300,000 tons, would still leave to be brought over the tariff wall 900,000 tons, and could not, therefore, in any degree affect the price of sugar in this market. If the price of sugar is not affected, then the sugar-growers and manufacturers of this country must also remain unaffected.

Figures with respect to tobacco and cigars are equally convincing that the timidity of the tobacco interests of this country in respect to the Philippine tariff bill is also unjustified. On the other hand, the opportunity to come into the markets of the United States would doubtless greatly benefit the business interests of the islands by a gradual improvement in the business tone, and we might expect ultimately the same prosperity that I have described already as conferred upon Porto Rico by the generosity of the United States in opening its markets to the people of that island. I have no doubt that in the future justice will be done in the matter of the Philippines.

THE PHILIPPINE ASSEMBLY

It may be objected that the $170,000,000 or more expended by the United States in suppressing the insurrection in the Philippines was not for the benefit of the Filipino people, resulting, as it did, in the death of many. This is a narrow view. No money or blood was ever spent more directly for the benefit of a people than this. The chaos which would have reigned and the bloody civil dissensions that would have followed, had we withdrawn from the islands and left them to their fate, under Aguinaldo and his generals, would have continued unabated for a decade, and the consequent prostrate condition of agriculture could hardly be overstated. The war was deplorable, but no other possible alternative was open to us in the discharge of our duty as a nation.

Only two laws can be said to have been enacted with a view to the selfish protection of American interests. One is the act by which the coastwise trade law will apply to the traffic directly between the United States and the Philippines. By amendment from time to time, however, its application has been postponed, and we may hope that these amendments will continue. The other is a law which discriminates in favor of goods exported directly to American ports by granting a rebate of island export duties attaching to such goods. It has reduced in a small amount the income of the islands to help American trade.

The assembly about to meet will doubtless be composed of men, a majority of whom will declare in favor of immediate independence. This is the natural result, because of the argument that appeals to the self-pride of the voters, that they are entirely fit for complete self-government. It is quite possible that much of the time of the assembly, in its first session, will be taken up in perfecting resolutions of this kind. I hope, however, that, after having given vent to their feelings upon this subject and having presented a respectful petition to Congress thereon, they may be induced to appreciate that the function of a national assembly is to legislate for the benefit of the country, and to come down to legislative action on humdrum subjects that do not necessarily involve eloquence and imagi-

nation, but do involve hard work and patriotic effort and make for the betterment of the islands.

The Philippine Islands have been treated with less generosity than either Cuba or Porto Rico, but still a great deal has been done by the United States for the Philippines and at a very heavy expense.

The statistics will show that in the case of each of the island governments the revenues have been largely augmented under American auspices, and also that the total of imports and exports has been materially increased; but the same is true of the expenditures. The Americans have given a more expensive government, because they have insisted on doing more in education, in public improvements, and in sanitation. It is easy for a government to be economical if it does not do anything.

One sometimes hears our character as benefactors to these Spanish islands questioned on the ground that the benefits conferred have been paid for by us out of the taxes collected in the islands, and therefore out of money belonging to our wards. I think I have shown by what has been said that immense sums have been paid directly out of the Treasury of the United States to aid them, and that very large sums which would be annually paid into the United States Treasury are diverted therefrom by our policy toward these islands. But, more than this, even with respect to those benefits paid for out of the revenues of the islands, are not the work of administration and the responsibility and care and judgment necessary to organize and maintain a government and devise the ways and means to better the conditions of a people to be regarded as altruistic, if only the good of the people is sought?

What has the United States received for all she has done

And now what has the United States received in return for all her efforts, for all her expenditure, and all her responsibilities? Let us look at her trade with the islands. In the fiscal year 1895, the last normal year of Spanish occupation, the imports into the United States from Cuba were $52,000,000; from Porto Rico, $3,000,000, and from the Philippine Islands, $5,000,000. In the fiscal year 1906 the imports into the United States from Cuba were $85,000,000; from Porto Rico, $19,000,000, and from the Philippine Islands, $12,000,000. The exports from the United States to Cuba in the fiscal year 1895 were $12,500,000; to Porto Rico, $3,000,000, and to the Philippine Islands, $120,000. For the fiscal year 1906 the exports from the United States into Cuba were about $48,000,000; into Porto Rico, $19,000,000, and into the Philippine Islands, $5,500,000. This shows a very considerable increase in the Cuban trade, a proportionate increase in the Porto Rican trade, but a smaller increase, though a considerable one, in the Philippine trade. In other words, the total trade with Cuba has increased from $65,000,000 to $130,000,000; with Porto Rico from $6,000,000 to $38,000,000, and with the Philippine Islands from $5,000,000 to $18,000,000, or a total increase in business done with these three islands of $110,000,000. While this shows a considerable increase, the profit therefrom is by no means equal to the great outlay I have set forth. I am sure that if the same liberal policy is continued and if the Philippine tariff bill of the last session is put into effect in the course of the next two or three years, that a decade, or certainly twenty-five years, will show an increase in business that will be more commensurate with the expenditure. But that increase will occur only if we continue the same altruistic spirit in dealing with these islands and give them every opportunity and aid to expand their own business and increase their own prosperous condition. In the meantime, and down to the present date, the outgo for the benefit of these islands has been enormous, while the income received by the people of the United States from them has been comparatively small.

If, then, we have not had material

recompense, have we had it in the continuing gratitude of the people whom we have aided? There have been many expressions at various times showing that at such times a feeling of gratitude existed, but he who would measure his altruism by the good will and sincere thankfulness of those whom he aids will not persist in good works. There are many reasons why we need not expect a continued feeling of gratitude from the peoples we have benefited. It is impossible always to secure American officials who are properly imbued with the spirit of sympathy for the natives that is essential to prevent race friction. We strive, of course, to go as little counter to the customs of the people as possible, but to secure needed reforms it is necessary sometimes to enforce laws that are not popular. Thus sanitary regulations needed to secure good health are irksome to such a people. They do not see the use of such severity.

Again, to carry on a government we must employ many Americans in the service, and we must, in order to secure them, pay them at a higher rate than the natives. Offices are much sought after by the natives, and the greater pay and discrimination in favor of the Americans are sure to engender dissatisfaction. We have tried to substitute natives for Americans as rapidly as possible, but we must retain some Americans for guidance. Then the native newspapers avail themselves of the freedom of the press and abuse the privilege by every kind of unfair statement to stir up native prejudice against the government and so against the Americans. This is not decreased by the hostile attitude of unthinking and unpatriotic American business men against the natives.

Finally, the character of the benefits we have conferred on these Spanish-speaking peoples is such as necessarily to imply our sense of greater capacity for self-government and our belief that we represent a higher civilization. This in itself soon rankles in the bosom of the native and dries up the flower of gratitude. It is natural that it should be so. We cannot help it. It is inseparable from the task we underake. Our reward must be in the pleasure of pushing the cause of civilization and in increasing the opportunity for progress to those less fortunate than ourselves in their environment, and not in their gratitude.

I have not touched upon and do not intend to discuss, for lack of time, what our future policy toward these three peoples must be. The problems to be presented are difficult and need a clear and calm judgment and a generous altruistic spirit for their satisfactory solution. Neither will be wanting, I am sure.

Our experience in the three countries of Cuba, Porto Rico, and the Philippines has many points in common, and the chief common feature has been the desire on the part of the American people, represented by the American Congress and the American Executive, to stimulate business, to elevate and educate the people, to maintain and preserve order, to introduce internal improvements of all sorts into the islands, to build roads and bridges and harbors, and gradually to enlarge as far as possible the control which the natives shall have over their own local government.

There have been times when abuses have crept into the administration of the islands on the part of some of the civil and military servants of the United States, but the record of the nine years since the beginning of the Spanish War, looked at from an impartial standpoint, is on the whole an unblemished record of generous, earnest effort to uplift these people, to help them on the way to self-government, and to teach them a higher and a better civilization. It is a record I confidently submit will always redound in the coming century to the high credit of the people of the United States as a generous civilizing nation charged by the accident of war with the responsibilities of guardianship of a less fortunate people and discharging that God-given responsibility in accordance with the highest ideals of the brotherhood of man.

SEVENTY-FIVE DAYS IN THE ARCTICS

By Max Fleischman

Life Member of the National Geographic Society

I HAVE so many times been asked what caused me to form the idea of spending the summer of 1906 north of the Arctic Circle that I feel impelled to give a brief account of the reasons which resulted in what proved to be the most interesting cruise it has ever been my privilege to enjoy.

I believed that with a good stout ship, properly equipped, a trip could be taken in those regions with comparative safety. I realized that it would be necessary to have the ship stocked with eighteen months' provisions, to guard against any unforeseen exigencies or of being frozen up in the ice of the far North. My chances were good, I thought, providing the ice conditions were in any way favorable, of getting into the east Greenland coast, making King William Land, and of being able to return the same year.

One fact, which I considered of primary importance, that assisted in deciding me to make the east coast of Greenland my objective point was that on Shannon Island and at another point near there are two Arctic relief stations, one established by the Baldwin-Ziegler Expedition and the other by the Swedish government under Nathorst.

Other objects of my trip were as follows:

To enter the Greenland coast near Franz Josef Fjord;

To attempt to secure live specimens of musk-ox and polar bear;

To collect specimens of bird life and study their food and habits of living;

Photo from Col. Max Fleischman

Polar Bear Crossing near Ice Fields

To make some short land expeditions;
To secure what shooting we could;

If ice conditions permitted, to advance north toward King William Land.

During the winter of 1905 I entered into correspondence with Mr Magnus K. Giaever, of Tromsö, Norway, and succeeded in chartering the auxiliary barkentine *Laura*. Mr Giaever is a ship-owner of much experience in the Arctic waters. Among other cruises, he accompanied Mr Champ in the latter's Baldwin-Ziegler Relief Expedition in 1905. Mr Giaever is also owner of the ship *Frithjof*, which was chartered by Mr Wellman for his Arctic work last summer and rechartered by him for his expedition this summer. In addition to fully sustaining his reputation as an Arctic outfitter, which had preceded my acquaintance with him, Mr Giaever proved a most agreeable companion and delightful gentleman. The *Laura* was well fitted and equipped for Arctic work, having good accommodations for dark-room, taxidermy, etc. In accommodations the *Laura* had six very comfortable deck cabins, 5½ by 6, and a combination deck dining-room and saloon. She carried from one hundred to one hundred and fifty tons of coal without a deck-load, on an average consumption of two ton per day in the ice, although relying principally on sail in the open sea.

The members of my party were as follows: N. C. Livingstone Learmonth, Hanford, Blandford, England; Dr C. R. Holmes, ship surgeon; Mrs Holmes, historian; Karl Holmes, and Mrs Fleischman. All of my guests save Mr Learmonth are Cincinnatians.

Dr Holmes and myself have been criticised for allowing the ladies to accompany us, but neither of us have had cause to regret having taken them along, as they stood the cruise surprisingly well, and Mrs Holmes and Mrs Fleischman cheerfully bear testimony that they gathered a great deal of pleasure and, if anything, received benefit from their entirely novel, if unusual, experiences.

I have also been asked if time did not hang heavily upon our hands, and how we managed to amuse ourselves in order to kill what some of our inquirers termed "the dullness of it." In answer to these inquiries it has been my pleasure to reply, that so far as the writer is concerned, there was not one dull moment during the whole trip, and in this statement I have enjoyed the hearty second of all who accompanied me. As soon as one is well in the ice, there is always the interesting anticipation of what is going to happen next. During a heavy Arctic fog, which sometimes lasts two or three days at a time and which necessitates tying up to an ice floe, one does not get dull. An overly anxious Arctic traveler may, perhaps, fret or chafe a bit because of these unavoidable delays at not being able to make progress toward his destination, but he or she of philosophic mind will sit down and play a few rubbers of bridge or listen to the musical grind of the phonograph. Far be it from me to say that any of my party were philosophers, nor were they the sons or daughters of philosophers, but we found that we could endure the fretting and still fight off ennui quite successfully because of our more or less expert knowledge of cards and our love for music. A phonograph on a trip of this kind is certainly a great source of pleasure and enables a befogged or ice-bound party to pass hours that might possibly otherwise be set down as "dull."

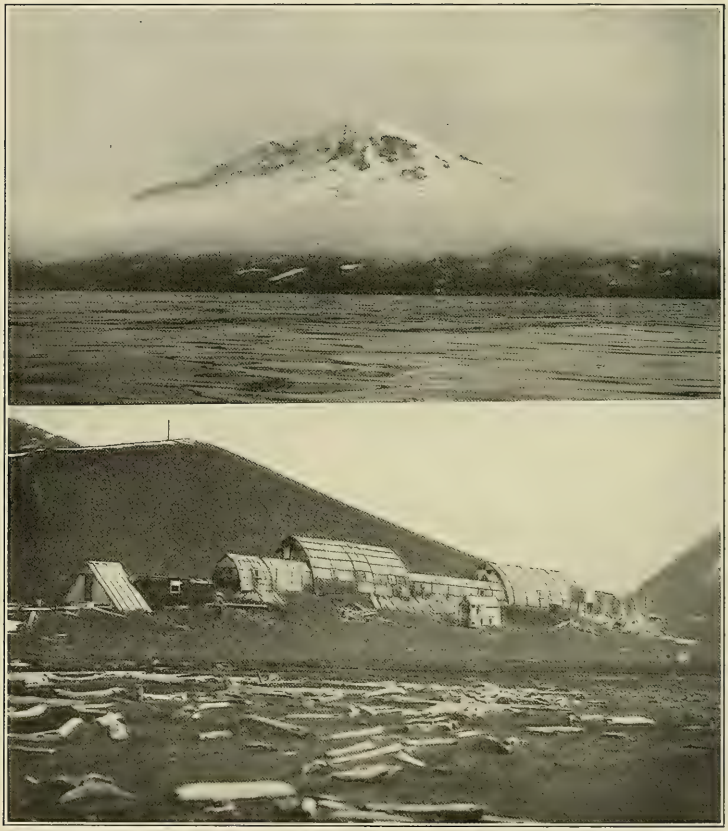
We went aboard the *Laura* at midnight on June 16, raised anchor, and proceeded north at 3:30 a. m. on June 17. Upon arriving at Skaaro a heavy gale made it unwise to put to sea, and we staid at anchor at that port until the 19th, before again putting out, our course being toward Spitzbergen. Passing Bear Island, we encountered heavy masses of drift ice.

As the experience of former expeditions had shown it to be inadvisable to attempt making the Greenland coast before July, it was decided to spend the intervening time in a shooting trip after reindeer. While the metaphor is badly applied, I might say that in our loafing we "killed two birds with one stone,"

Photos from Col. Max Fleischman

Character of Ice upon which Polar Bears are Hunted

Hunting Aboard the *Laura*—the First Bear



Photos from Col. Max Fleischman

Isle of Jan Mayen Enveloped in Fog

Houses on Jan Mayen Built by Austrian Expedition in 1882

as we had fair sport, bagging twenty-seven deer, thus giving us a fine supply of fresh meat, much better and at less cost than it would have been possible to obtain at Tromsö.

Advent Bay, another of our stops, contains the only two permanent settlements in all Spitzbergen—two coal companies, operated by American and English companies respectively. The coal appears of very good quality, much like our American Pocahontas. We filled our bunkers at a cost, approximately, of one pound sterling per ton. Coal croppings are very abundant all over the island. Lamont, during his Arctic trips, and many of the whalers have made a practice of taking their ships' boats ashore and recoaling from practically surface coal.

Spitzbergen, providing so many specimens of birds, kept us working overtime keeping up with our skinning, preserving, etc.

At a dinner given to both parties on the night before sailing from Tromsö we had promised to try to spend the Fourth of July with the Wellman party, so it was with pleasurable anticipation that we next proceeded to the Wellman camp at Virgo Haven.

Patriotism ran high in our American hearts as we lifted our hats on Independence Day to the Stars and Stripes, which were waving, not only over our own boat, but over the houses already in a fair way of construction by the expedition. Glorious Fourth of July was celebrated in a manner befitting true sons and daughters of Uncle Sam in that far-off land in the North. Not having fireworks or firecrackers, Major Hersey, U. S. A., second in command of the expedition and representing the National Geographic Society, commanded a squad armed with pistols, guns, or anything else that would, in line with Major Hersey's orders, "make a noise!"

At a conference with our officers, composed of the captain, Jens Oyn; first mate, Kristien Petersen, and second mate, Daniel Johansen, all of whom were veterans of the Arctic, having served as officers in the *Nathorst*, the Baldwin-Ziegler, and Antarctic expeditions, it was decided to try to reach the coast of Greenland between 74° and 76° north. The experience of former expeditions had shown this to be the most advisable route and promised the best chances of success, no ship ever having penetrated to the coast south of 73° and only one north of 76°. The last ships making any authentic attempt that had reached Greenland at that latitude were those of a Swedish government expedition under Nathorst, in the year 1900, and one other expedition, which attempted to get in at Franz Josef Fjord in 1905. It failed in that attempt, but succeeded in reaching land north of Shannon Island.

Small pieces of drift ice were first met in latitude 70° 5′, longitude 4° west.

Thursday, July 12 (latitude 70° 5′, longitude 0.21′ west), we encountered large but rather scattered drifts of ice and also had some heavy snow flurries. The temperature ranged 1° R.

July 15 we found ourselves on the edge of the main ice pack guarding the coast of Greenland. The sea was rolling so heavily, however, that we were in danger of being driven into the ice. Our course at this time was east southeast ¼ and our position latitude 76° 19′ 5″, longitude 1° 54′ west, but we changed our course to southeast in an endeavor to find a lead through which to force our way into the pack toward Greenland.

On the 16th we were fortunate in finding an ice bay which sheltered us from the force of the waves, and, following this lead, we were enabled to advance into the pack, where we were comparatively sheltered. Gigantic swells, however, showing the ferocity of the storm outside, followed us for a distance of over fifty miles through the ice. Our position at this time was latitude 74° 59′, longitude 3° 56′ west.

In this locality we secured our first specimen of hooded seal (*Cystophora cristata*).

Heavy fogs were also met with. The rigging was covered with a coating of ice

and the temperature was zero C. On account of the fog and the ice, which piled up thickly around us, it became necessary to savagely buck it in order to force our passage through to reach a stretch of fairly open water and to prevent being hemmed in. In this butting match we undoubtedly got somewhat the worst of it, as all the the ice plates on the port bow of the ship were wrenched from the bolts and were partly separated from the wood. We made water at the rate of one foot per hour, but, putting a double force at the pumps and lightening her weight forward, we were able to raise the ship enough to have the carpenters repair the leak. This accident, however, hindered us in a great way from getting through some heavy packs upon nearing the coast. We might possibly have come nearer our goal had it not occurred.

On Thursday, July 19, we saw our first bear—a large she bear, followed by two cubs about a year and a half old. They being too large to capture, we had a spirited hunt after them and succeeded in killing all three. The meat was fairly palatable, although it was necessary to cut it into very thin strips and hammer it very thoroughly before broiling, in order to get the "blubbery" taste out of it. In addition to this precaution, I would advise that a plentiful admixture of onions be used in broiling fresh bear meat, and if the onions are strong enough and one has a penchant for onions, one won't really mind bear steak. It is the opinion of the writer and also of the ship surgeon, who was the taster of all new food, that young seal is a great deal more palatable than bear meat.

By the 20th we had reached far enough into the ice pack to find that there was no evidence of any mud-discolored floes which we had observed on the outskirts of the pack. The authorities—Nansen, Nordenskiold, and Nathorst—all agree that this ice is carried by the currents from the Siberian coast.

In this connection the following excerpt from our log of July 20 may be of more than passing interest:

"The floes increased in area, and the surfaces, which hitherto had almost without exception been flat, were covered with a tumbled mass of irregular blocks of snow and ice, heaped one upon another, rising to heights of twenty and sometimes even to fifty feet. Incessant motion from currents and winds and reciprocal ice pressure, as the ice drifted from the inexhaustible storehouse of the North, forced the 'ice tables' one over the other and caused this condition in the interior of the Polar pack which is typical of what Arctic explorers term the East Greenland ice."

The temperature was still below the freezing point, the ice upon the rigging being quite thick, and the crystal fringe of icicles hanging from the edge of the many floes presented a very beautiful sight. We later sighted a big male bear, quite the largest specimen brought down during the trip. This bear weighed eleven hundred pounds.

On the 23d we killed a new variety of seal, called the snad (*Phoca vitulinia*). Our position at this time was latitude 74° 6′, longitude 13° 47′ west.

On Thursday July 26, at a position of latitude 73° 20′, longitude 13° 39′ west, from the "crow's nest" we could see the mountains of the coast, from Cape "Hold with Hope" to Pendulum Island, a distance of seventy-five miles. The atmosphere was remarkably clear. At this time we also shot a fine specimen of the stor-kobbe (*Phoca barbata*), the largest variety of seal ever killed in the North and found only in the proximity of the coast. Each seal of this class yields a barrel of blubber.

From July 26 until August 20 we were either enveloped in dense fog or beset in front, behind, or to either side of us by tremendous ice floes, so that our efforts to reach Greenland were fruitless and our course was of necessity changed to all points of the compass. Excerpts from our log covering this period are as follows:

"Held up three days by fog; thick ice; following a lead in the ice; impassable

ice; changing course; following another lead; trying to break through ice; solid pack; trying to get in north; trying to get in south."

The above entries in our log practically cover all our notes of moment until the 20th of August. It was first hope; then, as chance appeared better, it was high hope of reaching Greenland; then an obstruction of ice stopped us; now more fog, followed by still larger floes of ice; then a heavy fog again. We made no better than two knots an hour, and when tied up to an ice floe we drifted away southeast a knot to a knot and a half an hour. All in all, it was discouragement and expectation, apprehension and renewed hope, varying constantly by the sight of bear or seal and further enlivened during the time of our imprisonment by the capture of three polar bears alive. At one time we succeeded in reaching a point within twenty-odd miles of the coast, near Shannon Island, and at another time we were within thirty miles of the coast, near Franz Josef Fjord, but an impenetrable pack of ice blocked our further progress.

We also noted a very interesting fact in the presence of some uncharted currents, believed by us to be the Gulf Stream, in the pack at latitude 72° 2′ 34″, longitude 14° 39′ 30″. Here the water was of quite a different color, a strata about two feet from the surface showing a light green, and repeated tests showed it to be one to one and one-half degrees warmer than the darker water below.

On August 2d, at a time when our chances for reaching the coast were fast ebbing away, we noticed that new ice was beginning to form between the floes during the night, reaching a thickness of half an inch. This formation was caused by the older ice melting, thus creating fresh water, which was frozen much more readily than salt water.

On the 20th of August, our coal running somewhat low and there appearing to be no chance of improvement in conditions, we decided to give up hope of reaching the coast, and in consequence set our course toward the Island of Jan Mayen, reaching there the 24th of August. Jan Mayen is a peculiar island, shaped like a spoon, 33 miles long and 23 miles wide at the broadest point and 1½ miles at the narrowest. Here we saw Berenberg Mountain, rising 6,300 feet sheer from the ice, a glacier on one side. This was probably one of the grandest sights it has ever been my pleasure to view or hope to view again. Berenberg has never been ascended, although attempted several times.

It was on this island that the Austrian government left an expedition for meteorological survey in 1882. All of the houses of this expedition are still standing and they are in a good state of preservation. Several of our party had the unique experience of tasting some American canned food left there by the original expedition, finding that nearly twenty-five years of time had worked not a particle of damage to its remarkably excellent condition.

As a balm to our injured feelings, because of our failure to reach Greenland, we learned that one month after we arrived in Tromsö, another ship—a small steamer—had tried for the Greenland coast for the purpose of walrus hunting and sealing. This ship had been so badly beset by the ice that she had been frozen up in one pocket and had not gotten out for six weeks. At that time the ship was in such close proximity to us that she heard our large siren signaling some members of our party in one of our small boats, who had gotten lost in the fog and were trying to find their way back to the ship. She tried to signal us, but she was "down wind" and we could not hear her.

It was certainly a source of satisfaction to find that where we had failed no other ship had been able to succeed, and I do not believe that it would have been possible for any ship to have reached the east coast of Greenland during the past season.

I had the intention of trying again this year, but the master of the *Laura* advised against it, stating that it was his

opinion that it would be better to wait another year, to see if the ice would again reach normal conditions. I have therefore acted upon his advice and have taken the *Laura* for the year 1908 to again make an attempt to go in at the Greenland coast and reach King William Land.

NEAREST THE POLE

The substance of an address to the National Geographic Society by Commander Robert E. Peary, U. S. Navy, describing his explorations in 1905–1906.

TO many persons, even of more than ordinary intelligence and wide reading, all Arctic work is an effort to reach the Pole.

To such the following facts will be of interest:

The incentive of the earliest northern voyages was commercial, the desire of the northern European nations to find a navigable northern route to the fabled wealth of the East.

When the impracticability of such a route was proven, the adventurous spirit of Anglo-Saxon and Teuton found in the mystery, the danger, the excitement, which crystallized under the name North Pole, a worthy antagonist for their fearless blood.

The results of northern efforts have been to add millions to the world's wealth, to discover some of the most important scientific propositions, and to develop some of the most splendid examples of manly courage and heroism that adorn the human record.

While these efforts have steadily circumscribed the area for new discoveries, they have also ripened the time for the final culmination of the work and the closing of the chapter.

Though the unknown area has steadily decreased, there is still ample room in the two or three million square miles of yet unknown area for startling surprises in geography and the natural sciences.

If any proof of this were needed, it is to be found in the directly contrary conditions found by the last Peary Arctic Club Expedition as compared with previous theories.

Many and perhaps all of my friends in this Society are aware that my last two Arctic expeditions have been financed by the Peary Arctic Club of New York, an organization composed of prominent men of New York, Brooklyn, Boston, and Philadelphia, with Morris K. Jesup as its President.

SCIENTIFIC RESULTS OF THE LAST EXPEDITION

The point of view of Mr Jesup and his associates in the club has been that Arctic work today should combine in intimate coördination two objects—the attainment of the Pole as a matter of record and national prestige, and the securing of all possible geographic, hydrographic, and other scientific information from the unknown regions about the Pole.

And since the government has not considered it advisable to undertake the work, the club gladly assumed it and shares the resulting honor and scientific material with the country and its museums.

What have been the results of this broad view?

To the popular mind has been given the satisfaction of feeling that the Stars and Stripes stand first, and that we possess a new world's record in a field in which the most enlightened nations of the world have been striving to emulate each other for three centuries.

To the geographer is given the satisfaction of having his horizon greatly widened in the western half of the polar basin; of being able to fill in annoying blanks upon his charts, and of looking

forward with anticipation to detailed explorations of new land discovered. Added to this also is the definite determination of the insularity of Greenland—the arctic problem which Sir Clements Markham, President of the Royal Geographical Society, characterized as being second in importance only to the attainment of the Pole itself.

To the zoölogist comes the discovery of the beautiful white Arctic reindeer, ranging to the very limit of the most northern lands, from Robeson Channel westward to the one hundredth meridian, and the bringing home of a complete series of some fifty skins of this species; the securing of the first specimens of the beautiful salmon trout of Lake Hazen, and a wider extension of the known range and abundance of the musk-ox, the Arctic hare, the fox, and the existence of animal life, as represented by seals, to the very highest latitude reached, within some two hundred miles of the Pole.

The oceanographer has for his share a new series of tidal observations, samples of the bottom obtained from soundings off more than half of the north Grant Land coast and down Smith Sound to Cape Alexander; a cross-section of the American outlet to the Polar Sea at its narrowest point, and new information in regard to the character and movements of the ice in the Central Polar Sea, resulting in the demolition of the paleocrystic sea theory.

For the glacialist there are the numerous inert or comatose glaciers of the North Grant Land coast which Aldrich took for snow-covered points of land, and the great glacial fringe of North Grant Land from Hecla westward, which when its features are known will appeal very strongly to investigators in this field.

To the geologist the discovery of fossils at Cape Hecla and at the most western point attained will be of interest.

For the ethnologist there is a new and complete census of the entire tribe of Whale Sound Eskimos for supplementing and comparison with previous censuses made during the past sixteen years; also additional photographs and measurements of these people, and an extension of the known range of their ancestors in the high northern latitudes.

To the practical explorer, particularly those who will yet wrest their final secrets from Arctic and Antarctic regions, the experience of the expedition, its freedom from sickness and death, especially scurvy, which has been the bane of so many expeditions, even up to some of the later Antarctic ones; its methods and equipment, its rapidity of travel, and its evolution of what I believe will be the type ship for Arctic and Antarctic work—able to fight or drift or sail equally well, as circumstances may demand—afford valuable lessons.

For the meteorologist have been obtained thermometric, barometric, and allied observations, carried on through what was undoubtedly a distinctly abnormal season.

In view of the above, and the fact that the work has defined the most northern land in the world, and fixed the northern limit of the world's largest island, was that work a useless expenditure of time, and effort, and money? Neither the club nor I think so. The money was theirs, the time and effort mine.

To the popular mind, and especially my enthusiastic friends of the press, the fact that the Stars and Stripes are in the lead is the one that appeals with instant strength; and I do not wonder at it, for they and you and I are aware that any record that represents a manly test of brains and body is a distinct asset to any nation; and they and you and I know that when the wires tell the world that the Stars and Stripes crown the North Pole, every one of us millions, from child to centenarian, from farm laborer and delver in the mines, up to the "first gentleman" in the land, will pause for a moment, from consideration of his own individual horizon and life interests, to feel prouder and better that he is an American and by proxy owns the top of the earth.

But the scientific results are the imme-

diate practical ones, and British and foreign commentators do not obscure or overlook them; and these results, together with the expedition's non-loss of a man, entire freedom from scurvy or sickness in any form, and return of the ship, have had their very friendly comments.

No better illustration of the practical way in which these business men of the Peary Arctic Club have approached the work and of our own practicality as a nation could be afforded than the quiet way in which the club's expeditions have set forth, and particularly the recent return of the *Roosevelt* as compared with the return of Nansen's *Fram*.

The latter came into her home port with salvos of artillery, a harbor covered with boats, and its shores lined with a cheering multitude, congratulations from King and Parliament; and Nansen today is Norwegian Ambassador to Great Britain.

The *Roosevelt* steamed into New York harbor, lay at anchor for forty-eight hours, and went to her shipyard for repairs without a ripple.

Do not for a moment get the erroneous impression that I speak of this in a spirit of criticism or complaint; on the contrary, I understand the situation fully and am entirely in accord with it.

We are too big to need to assert our existence to the other members of the family of nations, and things which to a smaller country might be the event of its life, to us are only one of several items in the day's work.

THE JOURNEY NORTH

In July, 1905, Commander Peary left New York in the *Roosevelt,* a powerful steamer with auxiliary sailing power, the first vessel to be built in America for Arctic work. He sailed north across the Gulf of Saint Lawrence, along the coast of Labrador, through Baffin's Bay to Smith Sound, on the northwest coast of Greenland. To that point it was summer sailing and child's play. Then the real work began. For the next eighteen days it was a continuous fight, through varying vicissitudes of open water and packed ice, 350 miles, to Point Sheridan, on the north coast of Grant Land, where the winter camp was made.

Arctic exploration expeditions must be made in two seasons. Through one summer the explorer must drive his ship as far north as possible, and then establish his base near to land before the six months' night sets in, in October. From then until the last few days of February, when the first glimmerings of the Arctic dawn are seen, the explorer must live inert in a darkness that is relieved only once a month by the pale light of the moon. Then, when light comes for an hour or less a day, he must start north by sledge.

This Peary did. Four parties set north, each with its sledges and dogs and Eskimo drivers and hunters. These Eskimos, with their dogs, the Commander said, are the factors that make the search for the Pole feasible. Two days' march brought Peary's party to a lead—a rift in the ice pack where open water prevents further progress. For six days the party camped at this lead, until a thinly forming shell of ice gave them a precarious passage to the northern side. Only fairly started north from here, they were entirely cut off from the three supporting parties by a blizzard which delayed them five days longer. From then on the diminishing amount of provisions and the serious delays demanded that one mad rush be made to the north.

The Commander's lecture was illustrated with excellent stereopticon views, which gave the audience a true idea of actual conditions in the far north. Great hummocks of jagged ice, precipitous pressure ridges and obstacles that would seem insurmountable, stood constantly in the way of progress. But they pressed on at a heart-breaking gait until on April 21 Commander Peary was forced to give the word to turn back. He had set a new record, but the Pole, on the reaching of which he had so firmly counted, was

still 200 miles away—a distance he could have covered but for the sad delays caused by an open season and storms.

"At noon of April 21st we had reached a point which my observations showed to be in 87 degrees and 6 minutes north latitude, the nearest approach yet made to the Pole. It is perhaps an interesting illustration of the incongruity of human nature that at this time, when it might be thought that my feelings should be those of exultation only, they were as a matter of fact just the reverse. While I endeavored to be as thankful as possible for what I had accomplished, still the mere fact of breaking the record fell so far short of the splendid jewel to secure which I was straining my life out, that my feelings were of the intensest disappointment; and this, combined perhaps with the physical exhaustion resulting from our heart-breaking pace on half rations, gave me the deepest fit of the blues."

Turning south from his most northern camp, he traveled but a few days when, near the open water which had first intercepted him, he came across another lead from one-half to two miles wide. After camping two days and consuming almost all the few provisions left, pieced out by meat of weakest dogs, slaughtered because of dire necessity, a thin strip of ice was discovered across the lead. Over this, in skirmish line, each man fifty feet from his neighbor, they dashed, with the thin ice undulating under their feet and the danger of any moment sinking into the black waters of the Arctic sea constantly before them. No sooner had they lander on the firm ice of the southern side than the newly formed ice on the lead parted.

Emaciated men and starving dogs—only a few of the latter left—at last struck the coast of Greenland, with which Peary was familiar through previous trips. Here several Arctic hare which the Eskimos killed revived them slightly. Started on their first day's trip toward the west, they intercepted fresh tracks—three dogs and four men abreast, staggering as they went. Two runners sent east along this track returned in a day with Clark and three Eskimos, found as they had sunk down in exhaustion and despair to die a lingering and awful death.

For two days, with only short intervals of sleep, the party ate off the flesh of the muskox, seven of which Peary killed soon after reaching land. Then westward they went, until about June 1 the ship was reached.

FARTHEST WEST

Hardly recovered from the dash to the Pole, Peary started west along the north coast of Grant Land with a view to establishing some unknown coast lines. This journey took them west to the most northerly point of Grant Land, where a cairn was built and Peary's record and a strip of the American flag was deposited. This cairn is one of three such repositories which form a triangle of points established by Peary. One is on the most northerly point of Grant Land, and thus of the North American Archipelago; another is on the most northerly point of Greenland, and the third on the most northerly point in the world ever visited by man.

These three points, together with the explorations made by Nansen and Nordenskjold, make a fair investigation of the territory on the American and European sides of the Pole. The district lying north of eastern Siberia is the great unknown. What Peary terms the North American Archipelago is well explored as to coast lines, and but one strip remains unmapped on the northeast coast of Greenland. The Commander is absolutely confident that the Pole can be reached, this remaining strip explored, and perhaps a trip into the unknown toward Siberia made in one more journey to the north.

On return from the trip to the west Peary found that while his men had endeavored to change the position of the *Roosevelt,* she had become jammed in the ice and her rudder and two blades of

her propeller torn away. With speed reduced by a damaged propeller and a temporarily rigged and extremely crude rudder, the *Roosevelt* started homeward, landing at Cape Breton, Newfoundland, November 23, 1906.

The stereopticon views with which the lecture was illustrated were remarkably good, and were a great factor in making the story clear and in elucidating the situation about the Pole. Pictures of the Eskimos were especially interesting, showing women with animation in their faces—a quality that seems to be absolutely lacking in the average pictures of these people. Laughing babies, dressed exactly as are their fathers and mothers, were shown, and one remarkable type of feminine beauty, the daughter of a chief with whom Peary had become acquainted during former trips to the North. Pictures of the animals which are found in the Arctic regions showed strange-looking musk-oxen, a huge polar bear, large white Arctic hare, and some beautiful specimens of the snow-white Arctic deer.

IMPORTANT LESSONS TAUGHT BY THE LAST EXPEDITION

The drift of the polar ice flow is constantly to the eastward. On the side of the Pole adjacent to eastern Siberia and Alaska is a great field of ice, whence the chilled air flows east to equalize the barometric pressure in the north Atlantic, where from the perennially open waters the comparatively warm air rises. This wind, blowing with a constantly varying intensity, drives the packed ice eastward, and the explorer traveling toward the Pole is as a man attempting to row across a river.

This drift is that on which Peary counts for success on the next dash to the Pole, but it is also that which carried him from his destination on his last dash.

Had the winter of 1906 been a hard one and the ice pack closed in the spring, it is the Commander's firm conviction that he would not have had to turn back when within 200 miles of the Pole, and it is his belief that, taking advantage of the experience gained on this last trip, not only can the Pole be reached when the next dash is made from the American side, but that the one remaining unexplored strip of Greenland coast can be mapped at the same time. The sledge parties should start in the next trip from a point much farther west than did his sledges, and should aim not directly at the Pole, but toward a point west of it, so that the drifting ice will carry the party to it.

It is not severely low temperature that is the obstacle to Arctic exploration. A sound man, properly cared for and properly clothed, should not feel that as much as we in the temperate zone do the sudden changes of temperature to which we are subject. It is the long winter night—a nerve-wearing experience, one which has driven men insane—and the necessity of carrying all provisions which make Arctic exploration perilous.

"The discovery not only of the North, but of the South Pole as well, is not only our privilege, but our duty and destiny, as much as the building of the Panama Canal and the control of the Pacific.

The canal and the control of the Pacific mean wealth, commercial supremacy, and unassailable power, but the discovery of the Poles spells just as strongly as the others, *national prestige*, with the moral strength that comes from the feeling that not even century-defying problems can withstand us.

Accept my statement, the attainment of the North and South Poles (the opposite ends of the earth's axis) by American expeditions would be worth to this country many times the few thousands needed, just for the closer bond, the deeper patriotism resulting, when every one of the hundred millions of us could say, "The Stars and Stripes float at both ends of the earth's axis and the whole world turns about them."

Mere sentiment, perhaps; but sentiment has won battles and overthrown empires, and makes the difference between Satan and Saint."

PEARY'S TWENTY YEARS SERVICE IN THE ARCTICS*

The following article is from "Handbook of Arctic Discoveries," by Major General A. W. Greely, U. S. A., and is copyrighted by the publishers of the volume, Messrs Little, Brown & Co., of Boston.

THE most brilliant work on the inland ice is that of Mr R. E. Peary, U. S. Navy, who, in 1886, with a Dane, Maigaard, reached a point near Disco, some 50 miles from the sea.

Renewing his explorations in the *Kite*, Peary landed at McCormick Bay August, 1891, and most courageously persisted in his work, although his leg was broken while crossing Melville Bay. A house was erected, but autumnal efforts to establish a cache at Humboldt Glacier were futile. In 1892 Peary, able to travel, explored Inglefield Gulf in April, and then turned to the accumulation of stores at the edge of the inland ice, some 15 miles distant. His main journey commenced May 14, when the true inland ice was reached with 16 dogs and 4 sledges. He crossed the divide of 5,000 feet elevation between Whale Sound and Kane Sea, and at a point 130 miles from McCormick Bay sent back Cook, who had supported him thus far, with a man and two dog sledges. Peary proceeded with Astrup, and looked down into Petermann Fjord May 31; but crevasses here and at Saint George Fjord obliged them to make a detour to the east and southeast. Finally, on May 26, they reached the north edge of the inland ice, near 82° N., whence they looked to the north on the brown-red, comparatively ice-free land discovered by Lockwood in 1882. The fjord, into which they could not descend, doubtless connects with Nordenskjold Inlet of Lockwood, 1882, and Peary supports Greely's opinion of 1884, that Greenland here ends, and that the discovery of Lockwood is an entirely new land.

Unable to go farther north, Peary turned to the southeast to make the east coast of Greenland, and, following the edge of the ice-cap, reached Independence Bay July 4, 1892, and climbed Navy Cliff, 4,000 feet high, 81° 37′ N., 34 W. To the north was an ice-free land extending to the east some 50 miles, to 25° W. longitude; to the east and southeast the East Greenland Ocean was covered by disintegrating sea ice. Five musk-oxen were killed, which relieved anxiety for dog food on the homeward trip. The return journey to McCormick Bay, about 450 miles distant, was made almost in a straight line, the ice-divide proving to be 8,000 feet above the sea.

Believing that even more extended discoveries could be made in northeast Greenland by again crossing its ice-cap, Peary, raising funds for the purpose by a series of lectures, established a station at Bowdoin Bay in 1893. With 8 men, 12 sledges, and 92 dogs, he ascended the inland ice March 6, 1894, and in 13 days advanced 134 miles, to an elevation of 5,500 feet. Storm-bound by violent gales and extreme cold, Peary saw his dogs die and his men frosted, so that a general advance was impossible. Caching all surplus stores, principally pemmican, he sent back the disabled force, and with indomitable but fruitless energy marched on with three selected men. In 14 days he traveled only 85 miles, under extremely adverse conditions, being finally obliged to return with dying dogs and failing men. Abandoning sledges and caching pemmican, he reached Bowdoin Bay on April 15 with only 26 living dogs of the original 92.

Later his chief support, Astrup, sledged to Melville Bay and charted a considerable portion of its indefinitely located northeastern shore.

PEARY'S SECOND CROSSING OF GREENLAND

When the visiting steamer *Falcon* arrived, in August, 1894, prudence de-

manded that the entire party should return to the United States. Food and fuel were insufficient, more extended explorations were improbable, and arrangements for a visiting ship in 1895 were merely problematical. With determination and courage bordering on rashness, Peary decided to winter at Bowdoin Bay with two volunteers, Lee and Henson.

Utilizing throughout the winter the entire resources of the region and gaining Eskimo recruits, Peary accumulated supplies on the inland ice, and started northward April 2, 1895, with his 2 men, 4 Eskimo, and 63 dogs, drawing 6 sledges. On the third march an Eskimo deserted with his outfit; but Peary, undiscouraged, pushed on. Most unfortunately, the heavy snows had obliterated all landmarks, and the expected mainstay—the pemmican cache—could not be found. Failure now impended, but, sending back his Eskimo allies, from this camp, 134 miles inland and 5,500 feet above the sea, Peary continued his journey, 41 dogs dragging the 3 sledges. The temperatures ran from −10° to −43°; the elevation increased to 8,000 feet; travel was bad; sledges broke down; Lee was frosted; dogs died; but Peary persisted on his hopeless journey. Finally, with but 11 exhausted dogs, 1 sledge, and a disabled man, Peary, May 8, left Lee camped 16 miles from the coast, and with Henson sought game ahead unsuccessfully for 4 days. Scant walrus meat reserved could barely feed their dogs during the home journey, but with desperate courage they advanced their camp to Independence Bay, Peary's farthest in 1892. The descent to the sea practically destroyed their sledging equipment; but 10 musk-oxen restored vigor to men and dogs. Further game failing, with 9 dogs and food for 17 days, they turned homeward in a frantic race against starvation. Twenty-five forced marches, in which necessarily everything but food was abandoned, brought them, in desperate condition, June 25, to Bowdoin Bay, whence by the steamer *Kite* they reached Newfoundland September 21, 1895.

If Peary's advance beyond his buried cache was one of the rashest of Arctic journeys, yet the courage, fertility of resource, and physical endurance displayed by him and his companions place their efforts among the most notable in Arctic sledging. Other parties under less desperate circumstances have met with mortality, and only escaped total fatality by relief from their reserve party, which adjunct to Arctic exploration experience indicates to be essential to safety.

The two crossings of Greenland by Peary must be classed among the most brilliant geographic feats of late years, his journeys far surpassing in extent that of his ice-cap predecessor, Nansen, who crossed Greenland more than 1,000 miles to the south.

The physical collections and observations enlarge the previously existing wealth of scientific data of western Greenland. Doubtless the most important scientific results derived from the Peary voyages are those connected with Professor Chamberlin's examination of the glaciers of Inglefield Gulf, in which survey photography was freely used and to great advantage. Geology must profit from this study of glaciers presenting such varied forms, especially as the unusually free exposure of structure facilitated examination of vertical faces, convoluted and laminated formations.

The most attractive additions to knowledge are the ethnological studies of the Cape York Eskimo, which in 1895 numbered 253—140 males and 113 females. These studies, made by Peary, Lee, and Dr F. A. Cook, appear in a memoir forming an appendix to Peary's "Northward Over the Great Ice" (2 vols., New York, 1898), though very interesting details are scattered through the general narrative.

In a summer voyage of 1896 Peary obtained and brought from the vicinity of Bushman Island, east of Cape York, two large meteorites. The following year he was fortunate enough to be able to obtain and bring to New York city

the largest known meteorite of the world. It is an irregular mass, with maximum measurements of 6, 7.6, and 11.2 feet and weighs nearly 100 tons.

HIS FIRST CAMPAIGN TO REACH THE NORTH POLE

In June, 1898, he left New York for a four years' expedition against the Pole. His ship, the *Windward,* unable to force its way into Kennedy Channel, wintered near Cape Hawkes. In September of that autumn Peary determined the continuity of Ellesmere and Grinnell Lands. Through the utilization of the Etah Eskimo he planned to make Fort Conger his base for polar work. Adopting the unprecedented and dangerous policy of winter sledging, his trip to Conger in December badly crippled him and nearly cost his life, his feet being very badly frozen. Eight toes were amputated March 13, on his return to the *Windward,* yet he took the field in a few weeks. In July, crossing Ellesmere Land and passing over inland ice at an elevation of 7,000 feet, he discovered a fjord (Cannon Bay) running 50 miles to the northwest, with the north shore of Greely Fjord in the background, and probably Heiberg Land.

The *Windward* returning to the United States, Peary wintered (1899-1900) at Etah, from which he made his first northern effort. Leaving Etah in March, he started from Fort Conger April 11, taking the Greenland trail of Lockwood and Brainard. May 8 Peary passed Lockwood's farthest, 83° 24′ N., and reached the most northern land in about 83° 35′ N. Striking northward over the polar pack, Peary found "frightful going, fragments of old floes, ridges of heavy ice thrown up to heights of 25 to 50 feet, crevasses and holes masked by snow, the whole intersected by narrow leads of open water."

Finding that the pack was disintegrated, he turned back in May, 1900, from 83° 54′ N., nothing but ice being visible to the north from the summit of a floeberg 50 feet high. Following the coast of Hazen Land southeast to 82° 45′ N., 24° W., he turned back about 125 miles from Independence Bay.

Though the North Pole was not reached, yet the northern end of the Greenland Archipelago had been rounded and its eastern coast determined to Cape Independence. This journey practically completes the outlines of Greenland.

It is extremely interesting to learn that this northernmost land of the world is replete with animal and vegetable life. Bears, wolves, hares, and musk-oxen make it their habitat. Of the extreme northeastern coast Peary says: "It is inhabited by a fauna practically the same as that of other Arctic lands several hundred miles farther south."

The discoveries of Peary and Sverdrup confirm the opinion advanced by Greely, that the Eskimo, musk-ox, and wolf have reached east Greenland from the Parry Archipelago via Greely Fjord, Lake Hazen, and the ice-free regions of extreme northern Greenland. Traces of Eskimo life cover the greater part of the route, and Peary believes that summer would disclose others.

Returning south, Peary fixed his winter quarters at Fort Conger and attempted the Cape Hecla route in 1901, but the northern advance in April was abandoned at Lincoln Bay. His base was transferred the next winter to Payer Harbor.

Peary was not dismayed, and starting in February, 1902, by twelve wonderful marches reached Conger. Leaving, February 24, 1902, with nine sledges, he was stormbound a day at Lincoln Bay. In rounding Cape Henry he struck the worst ice-foot he ever encountered. By the slipping of a sledge two men nearly lost their lives, they dangling over the crest of an ice-pack precipice some 50 feet in height. The sledges had to pass a shelf of ice less than a yard wide, with the precipitous face of a cliff on one side, and on the other sea-floes 75 feet below.

Peary, having already traveled 400 miles in a month, with temperature ranging from −38° to −57°, left Cape Hecla April 6 with seven men and six dog

sledges. The disintegrating polar pack was constantly shifting, while its alternations of rubble, open water, young ice, and pressure ridges made travel slow and arduous in the extreme.

Strong gales not only kept them stormbound, but still further broke up the pack. Leads became frequent and wider, old floes broke up, and the moving ice-pack, crushing together with a sound of heavy surf, made the situation most dangerous. One lead was closed up by a huge pressure-ridge about 90 feet high. At the farthest, observations gave 84° 17′ N., 70° W.; magnetic variation, 99° W.

This notable northing, made from a base 300 miles south of the *Alert,* over Markham's route, exceeded his latitude by 57 miles. Peary surpassed the northing of Lockwood on Hazen Land by 53 miles, and so attained the highest latitude reached in the Western Hemisphere.

MAP OF THE NORTH POLAR REGIONS

THE Map of the North Polar Regions which is published as a supplement to this number was prepared by the Editor of the NATIONAL GEOGRAPHIC MAGAZINE to accompany the Scientific Report of the Zeigler Polar Expedition of 1903-1905. Through the courtesy of Mr W. S. Champ, executor for the late Mr Zeigler, and of Mr Anthony Fiala, leader of the expedition, the plates of the map were placed at the disposal of the National Geographic Society.

It has been the Editor's object to make a chart that would be historical as well as geographical. For instance, with the Franz Josef Land Insert is given a list of the principal explorers of the archipelago, while the more notable expeditions to the Smith Sound Region are printed with the Smith Sound Insert.

Peary's principal journeys are listed, the International Circumpolar stations of 1881-1883 are given, and the routes of the principal polar explorers shown. The coloring of the coast-line is intended to show as closely as possible the nationality of the first explorer.

The conjectural drift is also given of a cask which was dropped overboard from a whaler near Point Barrow in the summer of 1899 and picked up on the north coast of Iceland six years later. This cask was one of a large number which were specially constructed by the Geographical Society of Philadelphia on plans of Admiral George W. Melville, U. S. Navy, and Mr Henry G. Bryant, of Philadelphia, and which were placed on ice-floes north of Bering Strait in 1899-1901. Only this one cask has been recovered on the other side of the Polar Ocean. In its remarkable voyage it probably drifted 4,000 miles.

The probable drift of the alleged relics of the *Jeanette,* 1881-1884, is also shown. These relics, it will be remembered, were several broken biscuit boxes and lists of stores, said to have been written in the handwriting of Lieutenant De Long, and abandoned when the *Jeanette* sunk, in 1881. They were washed ashore on the southeast coast of Greenland three years later, where they were found by some Eskimo, who turned them over to a Danish officer.

Another interesting illustration of the powerful currents in the polar area is given by the track of the *Hansa's* crew in 1869-1870. The *Hansa* was one of the two vessels of the second German North Polar Expedition of 1869. The ship was crushed in the ice off Liverpool coast, and the crew compelled to camp on the ice-floe. They remained for 200 days, living on an iceberg, which meanwhile drifted 1,000 miles along the east coast of Greenland. They had managed to preserve a lifeboat, and when spring returned, after their terrible experience of the winter, spent in total darkness and drifting to and fro at the mercy of the

storm, they took to the boat and reached a haven.

Another remarkable drift was the experience of part of the crew of the *Polaris* in 1870. The *Polaris* had been pushed into an impassable ice-pack, where she was anchored to a floe.

"For two months the ship drifted slowly southward, when a violent gale disrupted the pack and nearly destroyed her. Part of the terror-stricken crew, escaping in the darkness to the ice-pack, experienced the horrors of a mid-winter ice-drift, whose appalling dangers and bitter privations can scarcely be appreciated. Five months later, after a drift of 1,300 miles, the despairing party were picked up by the *Tigress,* off Labrador, April 30, 1873, not only unreduced in numbers, but with a girl baby born to the Eskimo, Hannah."

The drift of the *Fram,* 1893-1896, is so well remembered that it is not necessary to describe it again.

It is also interesting to note the long distance Peary drifted on his last polar dash, while waiting for a lead to close and for a storm to abate. On his next campaign he will take advantage of this drift by starting west of Cape Columbia and by aiming for a point considerably away from the Pole. (See page 450.)

The many expeditions setting forth from Greenland and Franz Josef Land have nearly completed the exploration of the eastern half of the polar area, but the map shows a vast untraversed region north of Alaska and Bering Strait.

In the preparation of the map the Editor has received much assistance from the expert staff of the Mathews Northup Co., who also drafted, engraved, and printed it. The insert of the Smith Sound region is largely based on Peary's latest map, and that of Franz Josef Land on the surveys and revisions of the Ziegler Expedition.

A limited number of polar maps have been printed on linen and may be obtained from the National Geographic Society at 50 cents each.

The reader who is interested in Arctic exploration and wishes a concise narrative of the different expeditions, will find the "Hand Book of Arctic Discoveries," by Major General A. W. Greely, U. S. Army, an indispensable and welcome guide. A second edition of this volume has just been published by Messrs Little, Brown & Company, of Boston. General Greely gives a vivid summary of Arctic history, condensed from about 70,000 pages of original narrative.

NO MAN'S LAND—SPITZBERGEN

THE discovery of Spitzbergen excited little interest at the time, but it was prominently brought to the attention of the world by the first voyage of Henry Hudson, in 1607, to discover a passage by the North Pole to China and Japan.

Hudson's voyage was of vast industrial and commercial importance, for his discovery and reports of the vast number of walruses and whales that frequented the seas gave rise to the Spitzbergen whale fishery. Enterprising Holland sent its ships in 1613, bringing in its train later whalers from Bremen, France, and other maritime centers.

The whale fishery, as the most important of Arctic industries—from which Holland alone drew from the Spitzbergen seas in 110 years, 1679-1778, products valued at about ninety millions of dollars—merits brief attention.

Grad writes: "The Dutch sailors saw in Spitzbergen waters great whales in immense numbers, whose catch would be a source of apparently inexhaustible riches. For two centuries fleets of whalers frequented the seas. The rush to the gold-bearing places of California and the mines of Australia afford in our day the only examples at all comparable to the host of men attracted by the northern fishery."

During the most profitable period of the Dutch fishery, 1620-1635, it is within bounds to say that over 300 Dutch ships and more than 15,000 men annually visited Spitzbergen; more than 18,000 men were on the coast in one summer, says Lamont. It is definitely known that 188 whalers congregated at one anchorage in 1689, and in 1680 the Dutch sent out 260 ships and about 14,000 men, who made a catch at nearly a million and a quarter of dollars.

In the year 1620 whales frequented the bays and immediate coast of Spitzbergen in such numbers that the fishers were embarrassed to transport homeward the blubber and other products. These conditions led to the summer colonization of Spitzbergen (and Jan Mayen), where establishments for trying-out, cooperage, etc., were erected, as the most economical method of pursuing the industry. They were occupied only in summer, although the experiences of Pelham and other English sailors, who involuntarily wintered in Spitzbergen in 1630-1631, led to an attempt to establish a Dutch colony. The party of 1633-1634 wintered successfully, but that of the following year perished, and so ended the experiment.

The most remarkable of these establishments was at Amsterdam Island, where on a broad plain grew up the astonishing village of Smeerenberg. Here, nearly within ten degrees of the North Pole, 79° 50′ N., for a score of years, prevailed an amount of comfort and prosperity that can scarcely be credited by the visitor of today. Several hundred ships, with more than 10,000 men, visited it annually. These consisted not alone of the whalers and land laborers, but of the camp-followers who always frequent centers of great and rapid productivity.

In the train of the whalers followed merchant vessels, loaded with wine, brandy, tobacco, and edibles unknown in the plain fare of the hardy fishers. Shops were opened, drinking booths erected, wooden (and even brick) tile-covered houses constructed for the laborers or visiting whalemen. Even bakeries were constructed, and, as in Holland, the sound of the baker's horn, announcing hot, fresh bread, drew crowds of eager purchasers. If report errs not, even the Dutch frau of 1630 was sufficiently enterprising to visit Smeerenberg.

The shore fisheries soon failed (about 1640) and, the Dutch being driven to the remote and open seas, Smeerenberg fell into decadence; the furnaces were demolished, the copper caldrons removed, and the tools and utensils of the cooper and whaler disappeared; only the polar bear remained to guard the ruins of the famous Spitzbergen fair.

But human interest in Smeerenberg did not pass away with its vanishing habitations, for on the shores of that bay rest the last mortal remains of a thousand stalwart fishers, who closed their lives of toil and struggle in view of the icy seas that had often witnessed their triumphs over the mighty leviathan of the deep. Storm-stayed and ice-beset no longer, their dust awaits the change and fate ordained by God's eternal laws.

Spitzbergen of recent years has been claiming greater attention. A coal deposit of considerable value has been found on the island, and it has become a favorite resort for hunters and for excursionists. It is known as "No Man's Land," as it belongs to no country, Norway and Sweden being unable to agree as to its possession. Last year about half a million dollars' worth of oil, furs, and eider-down were obtained from the island.

Some authority ought soon to take possession of the archipelago, for the game—such as reindeer, polar bears, ptarmigan, geese, ducks, and other birds, formerly so plentiful—is being wantonly exterminated. A party of tourists last summer killed more than 100 reindeer, leaving the carcasses where they fell and taking with them only a few of the finest heads and antlers. Eider-duck nests are robbed of eggs, which Norway on her northern coasts and Denmark in Greenland protect by law.

Danes Island, on the northwest coast

of Spitzbergen, was Andrée's starting point in 1897, and here also Walter Wellman has established his headquarters.

ANDREE'S FATAL ATTEMPT

The most daring of all schemes of polar exploration was that urged and undertaken by S. A. Andrée, of Sweden. A member of the Swedish International Polar Expedition of 1882-1883 and an aëronaut of some experience, Andrée succeeded in commanding for his plan the active support of Oscar, King of Sweden, M. Alfred Nobel, and Baron Oscar Dickson. In 1896 his party passed several weeks at Danes Island, Spitzbergen, where they erected a balloon-house and failed to start, owing to adverse winds. Obsérvations of the escaping gas showed quite conclusively that the flotation life of the balloon had been overestimated. On his return Andrée had the balloon enlarged and improved, so that its impermeability and flotative powers were increased. With the gunboat *Svensksund* and tender *Virgo,* Andrée revisited Danes Island in June, 1897. The balloon-house had withstood the winter storms, and after the installation of the balloon all possible means were adopted to reduce to a minimum its daily loss of gas by permeation through the envelope. The plan looked to the flotation of the balloon some 800 feet above the sea by means of three attached heavy guide-ropes, each 900 feet long, to which in turn were fastened eight ballast lines, 250 feet long, with which it was expected by shifting the position of the guide-ropes to change the direction of the balloon. On July 6 a violent gale barely escaped wrecking both house and balloon. Finally, on July 11, the wind was favorable in strength and direction and everything was ready. The balloon, named *Ornen* (The Eagle), had its load of about five tons of food, ballast, freight, and men, and from measurements of escaping gas had a flotation life of about 30 days.

Acompanying Andrée were M. Strindberg and M. Fraenkel. At 2:30 p. m. the lines were cut, and the balloon ascended about 600 feet. Suddenly it descended to the surface of the sea, possibly owing to an entanglement of the guide-ropes, and then rose again as the ropes were cut or broken and ballast thrown out. The wind carried the balloon across the mountainous island of Vogelsang, making it necessary to rise to some 1,500 feet, whence it passed out of sight in an hour, below the northeast horizon. As the balloon had at its best a flotation life of 30 days, it is obvious that the report is erroneous of its appearance in Siberia 65 days later.

Three message-buoys have been found, all dropped by Andrée on July 11, the date of his departure, which furnish brief news of the course of the daring aëronaut. The latest was dated 10 p. m., at which time the balloon was in 82° N., 25° E. All were well, the weather fine, the balloon at 820 feet altitude, the direction towards N. 45° E., and the ice field below rugged. Beyond these buoys there have been found no traces, despite repeated search in various Arctic regions.

WELLMAN'S EXPEDITION

Spitzbergen has also been selected as the starting point of Walter Wellman's expedition to the Pole in an airship. On Danes Island, on the northeast coast of Greenland, he built last year an enormous shed in which to inflate his balloon, and established a large plant. He returned to Spitzbergen in June, taking his dirigible balloon, which has been considerably enlarged and equipped with more powerful motors than previously planned. The steel car suspended to the balloon has a promenade deck 50 feet long, and space to carry about 15 dogs to drag the sledges in case the party are obliged to abandon the airship. Mr Wellman believes the airship can be kept in the air 20 or 25 days. Spitzbergen is 600 miles from the Pole, and the trip there and back he estimates will take about 10 days. It will be remembered that Mr Wellman last year asked the National Geographic Society to

appoint a representative on the expedition to take charge of the scientific work. Major Henry E. Hersey, of the Rough Riders and the U. S. Weather Bureau, was so delegated by the Society and has gone north again in this capacity. Major Hersey, on his return from Spitzbergen in the fall of 1906, sailed with Lieutenant Lahm in the International balloon race from Paris, and it was his knowledge of meteorology that won the race for the Americans.

ARCTIC EXPEDITIONS COMMANDED BY AMERICANS*

EXPEDITIONS for Arctic exploration by Americans cover only about half a century, during which period they have both illustrated the resourceful courage of Americans and produced results comparable with those of European voyagers.

The following list of American expeditions is presented as of interest to our readers, and with the hope that its omissions and imperfections may be supplemented, so that the NATIONAL GEOGRAPHIC MAGAZINE may ultimately present a complete list of American voyages for Arctic exploration. The arrangement is generally, though not strictly, chronological rather than topical, although American effort has been especially active in the waterways to the west of Greenland.

The earliest expedition, extending aid in the search for Captain John Franklin, in 1851–1852, was the squadron commanded by Lieut. E. J. De Haven, U. S. Navy, its most northern work being in Wellington Channel, about 78° N.

Then followed the expedition of Elisha Kent Kane, nominally in search of Franklin, in 1853–1855, via Smith Sound, where, in 1854, Cape Constitution, in latitude 80° 35′ N., was attained.

Commodore John Rodgers, U. S. Navy, commanded the first American expedition to pass Bering Strait, reaching, in 1855, Herald Island, 71° 18′ N., 175° W.

In 1860–1861 Isaac L. Hayes reached, on the east coast of Grinnell Land, an indeterminate point, which has been placed as Cape Joseph Goode, in 80° 11′ N. Hayes and W. Bradford, in a summer voyage in 1869, reached with the *Panther* the vicinity of Cape York, Greenland.

From 1860 to 1862 and 1864 to 1869 Charles F. Hall explored the countries northwest of Cumberland Gulf. He reached, in 1861, Frobisher Bay; 1865, Boothia, in 68° N., 89° W.; 1867, Igloolik, Hecla Strait, 69° 22′ N.; in 1868, Fury Strait, about 70° N., and in 1869, Tod Island, off King William Land. In the Arctic Expedition of 1870–72, Hall reached, in the Polar Sea northwest of Greenland, 82° 11′ N., in 1870, and 82° 09′ N. on land in 1871. To effect the relief of Hall's Expedition, the *Tigress*, 1873, under Commander, afterwards Admiral, Braine, U. S. Navy, reached Littleton Islands, in 78° N.

The Franklin Search Expedition of Lieut. F. Schwatka, U. S. Army, and William H. Gilder, 1877–1879, thoroughly explored King William Land, reaching about 69° N.

The International Polar Expedition, under Lieutenant, now General, P. H. Ray, U. S. Army, took station, in 1881–1883, at Point Barrow, Alaska, in 71° 24′ N., 156° W.

Of the two Howgate expeditions, one, in the *Florence*, under Mr Sherman, a meteorologist, visited Cumberland Gulf in 1877, while the other, in the *Gulnare*, commanded by Lieut. G. A. Doane, U. S. Army, reached Disco, Greenland, in 1880.

Commander George W. De Long, U.

*The data for this article are very largely drawn from the exhaustive *Handbook of Polar Discoveries*, by General A. W. Greely.

Robert E. Peary, U. S. Navy

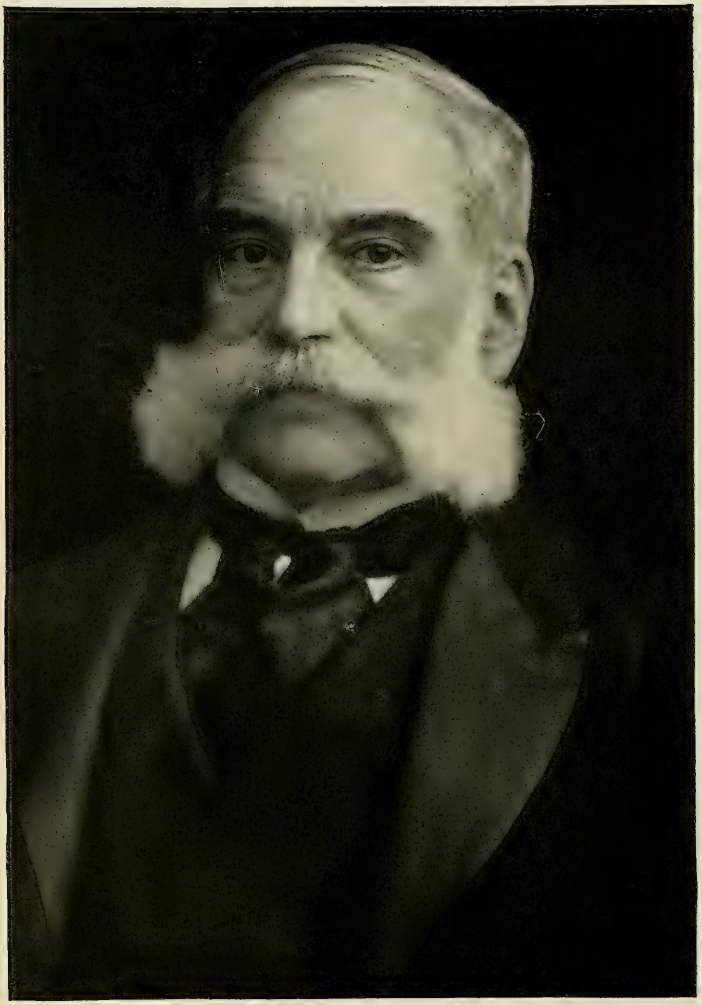
S. Navy, the first to explore the great Arctic Ocean to the north of Asia, 1879–1881, reached thereon 77° 36′ N., 155° E., in 1881.

In 1880 Captain C. L. Hooper, Revenue Marine Service, sailing on a summer voyage via Bering Strait, skirted the south shore of Wrangell Land,† about 71° 30′ N., 180° W., and landed on this island in 1881.

† Wrangell Land was first visited by an American whaler, Thomas Long, who sailed along its southern coast, reaching 70° 46′ N., 180° W., in 1867, in which year it was also skirted by other whalers, Captains Bliven, Phillips, and Raynor.

Commander R. M. Berry, U. S. Navy, in the Jeannette Relief Expedition of 1881, explored Wrangell Land to its northernmost point, in 71° 32′ N., about 180° W. In 1889 Captain, now Admiral, Stockton, U. S. Navy, reached Wrangell Land, in about 71° 30′ N., 180° W.

The Lady Franklin Bay International Polar Expedition, under Lieutenant, now General, A. W. Greely, U. S. Army, took station, in 1881–1883, on Grinnell Land,



Morris K. Jesup

President of the Peary Arctic Club and Honorary Member of the National Geographic Society

This and succeeding seven illustrations are from "Nearest the Pole," by Robert E. Peary, and are copyrighted by Doubleday, Page & Co.

Live Bull Musk-ox at Close Quarters—Cape Columbia

Typical Eskimo Dog

Egingwah and Reindeer at Cape Hubbard

A Study in Bronze

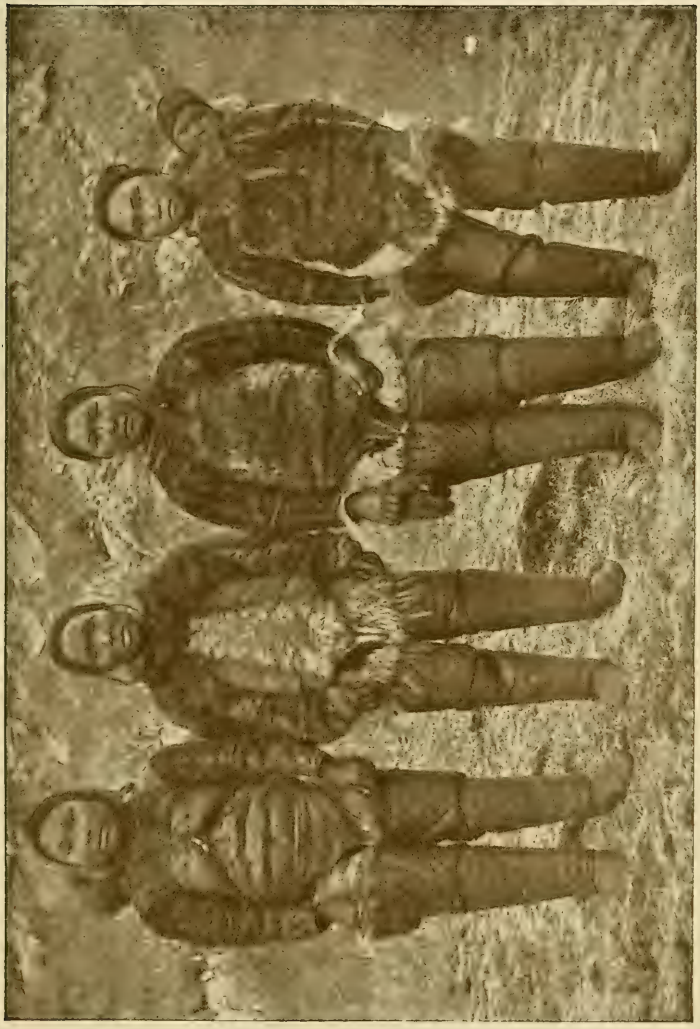
Typical face of Eskimo woman

Akatingwah

Wife of Ooblooyah, with baby

Sledging along Northernmost Land

An Eskimo Porter



A Group of Eskimo Women

in 81° 44′ N., 65° W. It attained, in 1882, 83° 24′ N., 41° W., on the northwest coast of Hazen Land. In 1883 it reached 82° 15′ W. on the northwest coast of Greenland, and also 80° 48′ N., 78° W., on Greely Fjord. The auxiliary expeditions of 1882, under W. M. Beebe, reached Cape Sabine, about 78° 30′ N., and that of 1883, under Lieutenant, now General, E. A. Garlington, U. S. Army, passed a few miles to the north of that cape, and Commander, afterwards Admiral, F. Wilde, U. S. Navy, reached that year the vicinity of Cape York, in the *Yantic*. The relief squadron of 1884, under Captain, now Admiral, W. S. Schley, U. S. Navy, likewise reached Cape Sabine.

Dr Franz Boas explored Baffin's Land in 1883–1884.

The most remarkable series of American expeditions is that due to the repeated efforts of Commander Robert E. Peary, U. S. Navy, which, beginning by a journey of fifty miles on the inland ice from Disco, in 1886, has ended in voyages, from 1892 to 1906 (except in 1897), that have covered entire north Greenland, northern Grinnell Land, and the adjacent Polar Sea. The main points reached were as follows: 1892, crossing the inland ice to Navy Cliff, 81° 37′ N., 34° W.; 1893, half-way across the inland ice, to about 80° N., 50° W.; 1895, across the inland ice to about 81° 40′ N., 34° W.; 1896 (summer voyage), Cape York; 1898, Fort Conger, 81° 44′ N., 64° W.; 1900, Polar Sea, 83° 54′ N., 30° W.; 1901, Lincoln Bay, about 82° N., 63° W.; 1902, Polar Sea, 84° 17′ N., 70° W.; 1906, Polar Sea, 87° 06′ N., *which is the nearest approach to the north geographic pole.*

Connected with Commander Peary's explorations there were auxiliary explorations, which visited the Greenland coast between Capes York and Sabine. Among these were: In 1891 and 1892, *Kite*, R. N. Keely and G. G. Davis; *Falcon*, H. G. Bryant, 1894, which reached, in Jones Sound, 76° 15′ N., 82° W.; the *Miranda*, under Dr F. A. Cook, visited, in a summer voyage, Sukkertoppen, Greenland, in 1894, about 67° N.; *Diana*, 1899, and *Erik*, 1901, H. L. Bridgman.

In 1894 Walter Wellman passed beyond Platen Island, north of Spitzbergen, reaching about 81° N. In his expedition to Franz Josef Land, 1898–1899, the latitude of 82° N. was attained by one party, while another reached 81° 26′ N., 65° E., on Graham Bell Island.

The Ziegler Expedition, commanded by E. B. Baldwin, in 1900–1901, reached Franz Josef Land, about 81° 30′ N.; that under A. Fiala, in 1903–1905, to Franz Josef Land, reached, in 1903, about 82° 04′ N. by sea. Auxiliary Ziegler expeditions in 1904 and 1905 were commanded by W. S. Champ, in *Fridtjof* and *Terra Nova*.

The expedition of Robert Stein to Jones Sound, 1899–1901, reached about 78° N.

A. P. Low, in the *Neptune*, after wintering in Cumberland Gulf, 1903–1904, reached, in the summer of 1904, Cape Sabine, Smith Sound.

There have been quite a number of Canadian expeditions, which, if not strictly Polar, were at least sub-Arctic. Among them may be mentioned the expedition of the Tyrrell brothers in the Barren Lands of Canada, 1893; the journeys of Dr Robert Bell in the Hudson Bay region, and especially his explorations of south Baffin Land in 1897; the discoveries of Ogilvie in the Yukon and Mackenzie basins, and the voyages of Lieutenant Gordon, Low, and others to Hudson Bay. J. E. Bernier, in *Arctic*, reached and landed on Melville Island, 75° 06′ N., 106° W.

Walter Wellman established his balloon depot in 1906 at Danes Island, Spitzbergen, 79° 40′ N., and now returns to that station during the present summer.

Photographed and Copyrighted by Edward S. Curtis

A Zuni Girl

NORTH AMERICAN INDIANS

THE series of illustrations of different Indian types printed on the following pages of this number have been selected from the collection of Indian photographs by Mr Edward S. Curtis, of Seattle. Mr Curtis is a trained photographer, who some years ago determined to make a photographic record of the Indian tribes of the United States. He realized how rapidly the habits and character of such few tribes as remain on the continent are disappearing and the great value of photographs to the future generations who will have no opportunity of seeing primitive Indians. As the work progressed, the importance and largeness of the task as well as the expense of the undertaking became more and more apparent, but Mr Curtis continued the work for nine years unaided. Last year, however, he enlisted the coöperation of Mr J. Pierpont Morgan, of New York, who is contributing a generous sum toward the field work in order that the series of photographs may be completed more rapidly and the

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Hopiland

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Hopi Children

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Hopi Maiden

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Sohowa Poqui—San Ildefonso Girl

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A Mohave Mother

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In the Orchard—San Ildefonso

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A Crow Youth

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At the Pool—Crow

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Apache Mother and Babe

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Chedeh—Apache

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Son of the Desert—Navaho

Photographed and Copyrighted by Edward S. Curtis

A Navaho

Photographed and Copyrighted by Edward S. Curtis

Water Carriers—Acoma

whole work published. It is estimated that the field work will cost about $250,000. The following is quoted from the preface to the first volume which will be issued in September.

"It is the purpose of this series of volumes to give a complete record of all the tribes of North American Indians within the limits of the United States that are at the date of these studies (1898-1911) living in anything like a primitive condition.

"All phases of the Indian life are pictured—the Indians and their environment, the types of the old and young, their primitive home-structure, their handicrafts, their ceremonies, games, and customs—with an object, first to truth, then to art composition.

"In these illustrations there is no making of pictures for pictures' sake. Each must be what it purports to be. A Sioux must be a Sioux and an Apache an Apache; in fact, every picture must be an ethnographic record. Being photographs from life and nature, they show what exists, not what one in the artist's studio presumes might exist.

"It is not the purpose of these volumes to theorize on the probable origin of the Indian. This is what he is, not whence he came. The years of my life and the magnitude of the work preclude the possibility of going into the complete detail of many questions raised by the different tribes. However, it is possible to treat the life so fully as to show future generations broadly what each group was like."

The publication will consist of twenty volumes of text, accompanied with fifteen hundred full-page photogravures. Several of the photogravures in each volume will be hand-colored plates of ceremonial subjects.

Each volume will consist of about 350 pages, measuring 9½ x 12½ inches. The best imported hand-made paper will be used, one selected particularly for its lasting qualities.

As a supplement to the twenty volumes, there will be twenty portfolios, each containing thirty-six of the large pictures, 12 x 16, or in the complete set there will be seven hundred and twenty large pictures and fifteen hundred of the small, making a grand total of twenty-two hundred and twenty, these all to be of the very best photogravure work.

Mr. Frederick Webb Hodge, of the Smithsonian Institution, and editor of the "American Anthropologist," is the editor of the work. President Theodore Roosevelt has written the "Foreword."

It is published in parts, each part being complete in itself, treating of certain tribes. Parts will be delivered as completed, the plan being to publish an average of three a year and the work completed within seven years.

The first two volumes, which will appear in September, treat of the Apaches, Jicarillas, and Navahoes. Volume 2 will cover the many tribes in southwestern Arizona and in the Colorado, Gila, and Salt River valleys. The different Sioux tribes of North and South Dakota will come next in order in volume 2, and volume 4 will treat of the tribes of eastern Montana. The fifth volume will depict the tribes of western Montana and Idaho, and the sixth the tribes of eastern Washington.

Other volumes will take up the Mission Indians of southern California, the aborigines of northern California and Oregon; those on the northern Pacific coast and Puget Sound and the coast Indians of Alaska and the Pacific coast. One will be devoted to the Hopis and one to the other different Pueblo tribes. There probably will be a volume on the Seminoles of Florida, and Canada will have, without doubt, one volume which will practically be what might be called a treatise on the "Wood Indians." The final volumes will take up the tribes in Oklahoma and Indian Territory.

President Roosevelt has written the "Foreword" which follows:

"In Mr Curtis we have both an artist and a trained observer, whose pictures are pictures, not merely photographs; whose work has far more than mere ac-

curacy, because it is truthful. All serious students are to be congratulated because he is putting his work in permanent form; for our generation offers the last chance for doing what Mr Curtis has done.

"The Indian as he has hitherto been is on the point of passing away. His life has been lived under conditions through which our own race passed so many ages ago that not a vestige of their memory remains. It would be a veritable calamity if a vivid and truthful record of these conditions were not kept. No one man alone could preserve such a record in complete form. Others have worked in the past, and are working in the present, to preserve parts of the record; but Mr Curtis, because of the singular combination of qualities with which he has been blessed and because of his extraordinary success in making and using his opportunities, has been able to do what no other man ever has done; what, as far as we can see, no other man could do.

"He is an artist who works out of doors and not in the closet. He is a close observer, whose qualities of mind and body fit him to make his observations out in the field, surrounded by the wild life he commemorates. He has lived on intimate terms with many different tribes of the mountains and the plains. He knows them as they hunt, as they travel, as they go about their various avocations on the march and in the camp. He knows their medicine men and sorcerers, their chiefs and warriors, their young men and maidens. He has not only seen their vigorous outward existence, but has caught glimpses, such as few white men ever catch, into that strange spiritual and mental life of theirs, from whose innermost recesses all white men are forever barred.

"Mr Curtis in publishing this book is rendering a real and great service—a service not only to our own people, but to the world of scholarship everywhere."

George Bird Grinnell writes as follows:

"I have never seen pictures relating to Indians which, for fidelity to nature, combined with artistic feeling, can compare with these pictures by Curtis. To-day they are of high scientific and artistic value. What will they be a hundred years from now, when the Indians shall have utterly vanished from the face of the earth? The pictures will show to the man of that day who and what were his predecessors in the land. They will tell how the Indian lived, what were his beliefs, how he carried himself in the various operations of life, and they will tell it as no word-picture could ever tell it. He who remembers the two or three plates in Jonathan Carver's 'Travels,' or Bodmer's splendid illustrations in Maximillian's great work, cannot fail to realize how great a difference exists between a written and a pictured description.

"The pictures speak for themselves, and the artist who has made them is devoted to his work. To accomplish it he has exchanged ease, comfort, home life, for the hardest kind of work, frequent and long-continued separation from his family, the wearing toil of travel through difficult regions, and finally the heart-breaking struggle of winning over to his purpose primitive men, to whom ambition, time, and money mean nothing, but to whom a dream or a cloud in the sky, or a bird flying across the trail from the wrong direction, means much."

THE EAST INDIANS IN THE NEW WORLD

By Harriet Chalmers Adams

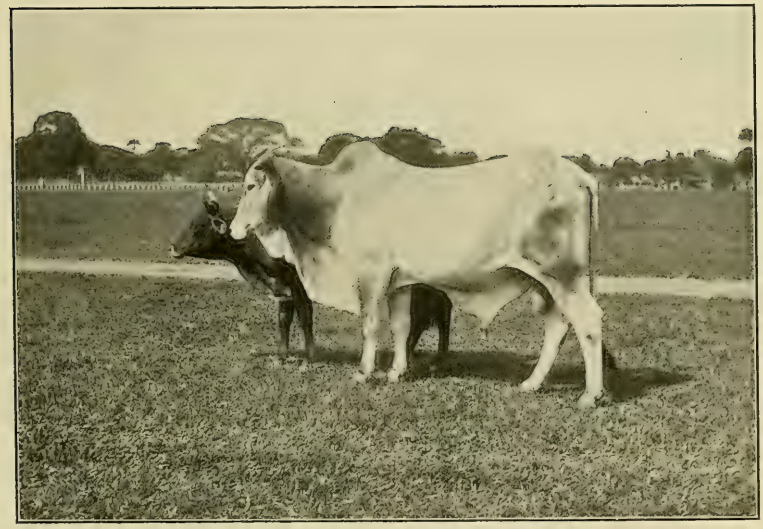
"IN my trip around the world, I met no people so picturesque and interesting as the Hindus," said a woman to me the other day. "I regret that India is so far away," she added, "for I long to study its attractive natives."

I surprised her by stating that she need not return to India to fulfill her desire; that not far south, in our own half of the world—in Trinidad, most beautiful of the West Indian islands—are over one hundred thousand transplanted East Indians. On the mainland of South America, also, in British and in Dutch Guiana, are found in large numbers these quaint people of the Old World.

Transplanted by the British government as indentured laborers to work upon the sugar estates, these orientals have brought with them their home customs, dress, and religion. Especially in Trinidad one delights in studying them, since that verdant isle seems a pleasing setting for the grace and beauty of the dusky women, the strength of feature and dignity of bearing of the turbaned men.

Perhaps it is by contrast with the coarse Africans, who form the greater portion of the population of the West Indies and the Guianas, that these people of an ancient race stand out in the traveler's remembrance as a more fitting type in lands of such great natural beauty.

We were in Port of Spain, Trinidad, at Christmas time, a year ago, and on a number of days during the holiday season the great "savanna," or park in the heart of the city, was thronged with the



Sacred Zebus from Far-away India

In Her Working Gown

"coolies," as the East Indians are locally termed.

It was a brilliant picture — the dark-eyed, dark-haired women draped in their brightly colored scarfs, their plump arms covered with heavy silver bracelets, their ears, noses, necks, and ankles decorated with gold and silver ornaments; the men in sombre shades, but equally picturesque in their huge white turban and abbreviated loin-cloths, their thin legs bare. Temporary booths were erected under the great spreading saman trees, where brass ornaments from Benares were displayed, while, as another reminder of far-away India, zebus, or sacred oxen, grazed near by.

From my window I gazed out over this kaleidoscopic scene to the purple hills, crowned with mist, which form a background to the grassy "savanna," and wondered if any picture could be more effective.

The "coolies" who are employed on plantations scattered over the island meet in town on such holidays to greet friends and relatives, to gossip, and to trade. At other seasons one may see them throughout the country, laboring in the

In Town for a Holiday

cane fields, bearing burdens along the well-kept roads, or busily employed in or about their thatched cabins.

Their activity is a decided contrast to the idleness of the blacks, and indeed to the indolence of the Africans may be traced the cause of "coolie" immigration to this portion of the New World. As long ago as 1838, after the emancipation of slaves in British Guiana, labor became unavailable, the negroes refusing to work excepting for exorbitant wages. As a natural result, the owners of the sugar estates were ruined and the plantations were abandoned. The salvation of the colonies lay in the introduction of Asiatics by the imperial government.

A unique sight today in the harbors of Port of Spain and Georgetown is the arrival of a "coolie" ship laden with its oriental cargo. What stories of human interest might be written of these silent, bronze people facing new experiences in a strange land! Many of them feel that they may never return to Calcutta, since by crossing the seas they have defied an edict of that terrible god of the Hindus, "caste."

The passage of the East Indians is paid by the government, as are certain agreed wages during their term of indenture. Having served the allotted time, they are given passage back to India or permitted to live as "free coolies" in the colonies. Comparatively few avail themselves of the return passage, preferring to remain until they have saved sufficient capital with which to establish themselves in

Hindoos Employed on a Cacao Estate—Trinidad

"Holy" Men from the Far East—Trinidad

Bronze Beauty—Trinidad

their native land. They become planters and merchants in a small way and many of them leave British soil for the near-by Dutch colony.

Incomprehensible to the western mind are the ways of these people. The husband not only owns the jewelry with which he decks his wife, but appoints himself judge of her right to live. Defying the majesty of the law, he chops off her head if she prove unfaithful, or resorts to the more refined method of sprinkling powdered glass in her food. Mysterious deaths are of frequent occurrence and the government chemists are kept busy investigating such cases.

The women are attractive in appearance, with appealing eyes, rounded arms, and lithe bodies. It is their custom to massage daily with cocoanut oil. They have a passion for gaudy colors, and in gala attire resemble "a flock of rainbows."

The men are solemn-looking creatures, with those all-knowing eyes of the Far East, and the long-haired priests are positively uncanny. In passing one of these "holy men" on the highway, I invariably looked over my shoulder furtively, expecting to see blossoming rosebushes springing out of space and lads climbing skyward on invisible ladders.

We engaged one of the magicians to perform for us at our hotel, but evidently he was not "the genuine article" or we were so skeptical as to dispel all illusions. We felt at his departure that we had not received our two shillings' worth of "thrills" and that sword-swallowing detracted from the dignity of an adept.

The Hindus look with horror on the custom of eating beef, since to them the bull is sacred. Strange are the ways of Fate, that these people should now be ruled by a race who regard beef as the important article of diet!

The cross of the East Indians in the New World is the enforced association with the Africans. These "lords of all creation" look with contempt upon the orientals. "He only a coolie man!" says the lazy, ignorant negro, disgust written on every line of his face. The brown man—this descendant of an old and proud race, who regards the negro as little more than a savage—does not retaliate, but goes steadfastly on with his work.

One day I met three types on a country road near Georgetown—an East Indian, a negro, and a native Indian. The latter was bringing from his forest home into town baskets and hammocks of his own manuufacture for sale at the market. His dignity of bearing equaled that of the one whose namesake he is, and the African suffered by contrast with both.

In associating the Hindus with life in the West Indies and the Guianas, it has seemed to me a strange coincidence that these East Indians, whom Columbus thought he had discovered, should have drifted at last to the New World, to mingle with the surviving American aborigines, who, through the Great Admiral's mistake, bear their name.

GEOGRAPHICAL CONGRESS

THE preliminary program has been issued of the Ninth International Geographical Congress, which will be held at Geneva, Switzerland, July 27 to August 6, 1908. The Congress is under the auspices of the Geographical Society of Geneva, which at the same time celebrates the fiftieth anniversary of its founding. The Honorary Presidents of the Congress are the President of the Swiss Republic, the President of the Federal Council and of the Canton of Geneva, the King of Belgium, and the King of Roumania. The President of the Congress will be Dr Arthur de Claparède, President of the Geographical Society of Geneva. The committee in charge requests that all papers to be submitted to the Congress be handed in by November 1, 1907. A series of interesting excursions to different parts of Switzerland is being arranged under the auspices of the Congress.

A Moqui Girl of New Mexico

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The NATIONAL GEOGRAPHIC MAGAZINE

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Flashlights from the Jungle. Illustrated.

Saint Stephen's Fête in Budapest. By DeWitt Clinton Falls, Member of the National Geographic Society. Illustrated.

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MEXICO—THE TREASURE HOUSE OF THE WORLD*

By N. H. Darton

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THE great development of Mexico's resources during the last thirty years has justified to a large degree the statement of Baron von Humboldt that "Mexico is the treasure house of the world." Her rich silver mines have continued to produce in increasing amount, gold has become an important product, and she has taken prominent rank in the copper industry. Her agricultural products have gained rapidly in value, manufacturing has increased to an encouraging extent, and commerce with the outside world has multiplied many fold.

Foreign capital has flowed into the Republic, especially in later years, and many investors, confident of a continuance of the present stable conditions, are eagerly taking advantage of the many mining, railroading, manufacturing, and other openings which are available. The finances of the country are on a most satisfactory basis, many great public improvements have been made, and the government is offering encouraging facilities along all lines of development. Colonists are coming slowly, but as the conditions become better known they will undoubtedly take advantage of the large areas of public lands that are easily obtainable and in many regions can be utilized with great profit.

The native labor is increasing in effectiveness, for many of the laboring people are showing considerable capability as workmen and artisans when properly trained. Lawlessness is no longer a menace to person or property, railroads are rapidly penetrating all parts of the country, and conditions of living are greatly improved.

There is but a relatively small proportion of Mexico which is unhealthful to foreigners, and many improvements have been made in this regard, notably in draining the overflow area about the City of Mexico.

With her wide range of altitude, latitude, and rainfall, Mexico presents various climatic conditions with a corresponding variety of agricultural possibilities. She has large areas suited for wheat, corn, and other products of the temperate zone, and in the hot, moist lowlands can raise a great variety of

* An address to the National Geographic Society, April 5, 1907

Photo from Mrs Alexander Graham Bell

In the Suburbs of Mexico City

valuable tropical plants. Irrigation will reclaim many thousand acres in the north-central arid districts. Water power is available for manufactures, considerable coal exists in certain areas, and it is believed that petroleum may occur in sufficient amount to be an important auxiliary fuel.

THE PRINCIPAL SILVER-PRODUCING COUNTRY OF THE WORLD

Probably the most valuable resources in Mexico are the great mineral deposits, and mining will long continue to be her principal industry. For many years Mexico has produced more silver than any other country, and now is gaining rapidly in output of gold, copper, and other metals. In 1906 the estimated value of her mineral production was $150,000,000 (Mexican), of which about two-fifths was silver. During the past few years numerous old Mexican mines have been revived, some of the abandoned ones pumped out, and modern methods installed. Large bodies of mineral have been discovered at many new localities. In some cases these yield rich ores, while in others they are of moderate richness, but can be worked profitably by new processes.

The extension of the railroad lines in various directions through the mineral country has been an important factor in development, for they afford outlet for ores which are not sufficiently rich to carry long distances by wagons or burros in the old-time manner. Smelters have been erected at many places and additional ones are in course of construction for the economical working of ores of various kinds. Modern methods of concentration are introduced at some mines, which effect a saving so great that low-grade ores formerly thought to

Photo from Graham Ker

Pottery Vendors

Photo from Mrs Alexander Graham Bell

Indian Types

be of no value often can be worked with considerable profit. There are vast quantities of refuse and tailings from old mines and primitive reduction works which contain large values, and some of these are being worked over with most satisfactory results. Often the fairly good ore was discarded in the early days, when only the high-grade material was worth freighting. On the old dumps at one mine in San Luis Potosi there were over 300,000 tons of mine refuse containing much metal. In Guadalajara tailings have been used for asphalt paving which recently were found to run $15 a ton in gold and silver. Electricity, generated mostly by water power, is now being utilized at some mining districts and proves to be a great source of economy.

It is estimated that about $80,000,000 of United States capital are invested for purchase and equipment of Mexican mines and large amounts have also been invested from other countries. The present high price of the various metals has given impetus to Mexican mining, while the large amount of capital available in the present high tide of prosperity in the United States has been an important factor. The known mineral districts in Mexico are numerous and extensive and many portions are by no means fully developed. There are numerous regions also in which the mineral resources may prove important which have not as yet been explored by skilled prospectors.

The following table, taken from the *Mining World* for January 26, 1907, gives the principal metal production of Mexico for the past 27 years:

Metal Production of Mexico

Year.	Gold.	Silver.	Copper.	Lead.
	Fine.	*Fine ozs.*	*Met. tons.*	*Met tons.*
1880..	$989,160	19,334,707	407	.....
1881..	858,909	21,265,052	339	.....
1882..	936,223	22,465,430	408	.....
1883..	956,000	22,720,004	497	.....
1884..	1,183,000	20,944,185	295	.....
1885..	867,000	24,674,011	378	.....
1886..	614,000	25,356,196	254	.....
1887..	824,000	28,867,830	2,083	15,488
1888..	974,000	31,789,739	2,811	28,636
1889..	700,000	42,657,583	3,841	25,570
1890..	767,000	39,127,481	4,396	22,399
1891..	1,000,000	40,723,598	5,209	30,186
1892..	1,147,500	45,333,786	7,916	47,532
1893..	1,305,000	44,071,851	9,607	60,525
1894..	4,500,000	46,730,151	11,959	57,000
1895..	5,600,000	50,890,267	11,958	68,000
1896..	6,075,108	41,373,835	11,338	63,000
1897..	7,121,189	54,052,647	11,553	71,637
1898..	8,236,720	56,859,076	15,919	71,442
1899..	9,277,351	55,032,838	19,310	84,656
1900..	9,409,063	55,804,420	22,473	63,827
1901..	10,329,316	55,152,340	33,943	94,194
1902..	10,153,100	60,176,604	36,357	106,805
1903..	10,677,500	70,499,942	46,040	95,134
1904..	12,605,300	60,808,978	51,760	101,131
1905..	15,261,200	54,652,893	70,010	96,628
1906..	16,250,000	54,500,000	61,706	78,026

The silver mines of Mexico have been the principal source of her income from mining for over a century, and they are likely to continue their large and gradually increasing production for a long time to come. Some of the old mines have had phenomenal production, notably the group in Zacatecas, which has yielded about one billion dollars; the Santa Eulalia mines, 15 miles east of Chihuahua, 400 millions, while several scores of others have many millions to their credit. Some of the mineral deposits are over 100 feet in width and are traceable for long distances across the country. They occur mostly in volcanic rocks or in limestones associated with them. The minerals present considerable variety and usually are very irregularly disseminated. Many large masses of rich ore occur, and these "bonanzas," as they are termed, have added greatly to the profit and excitement of the mining operations. Some of them have yielded over a million dollars a month for several years. They are often widely separated by lean ore, a condition which has caused the failure of many companies lacking means to continue working under disadvantageous circumstances. Water has often caused failure or great expense, especially when old-fashioned pumps were in use.

At present the most productive silver and gold mines in Mexico are at Guanajuato, El Oro, Pachuca, Santa Eulalia, Parral, and Zacatecas. At the first-named place there has been rapid development; about 2,000 tons of ore a day are now produced and 650 stamps are dropping in the various mills. The crude, wasteful methods of the past have given place to modern ones. Ores carrying 20 dollars a ton, which formerly yielded only a small margin of profit, are now mined and milled for 10 dollars a ton. For many ores plate amalgamation and cyaniding are taking the place of the old patio process, with great increase in yield and saving of time and expense. The patio process was invented in Mexico over three centuries ago and has been used for the greater part of Mexico's silver output. In this process the ore is ground fine in mills, mixed with water, and, after the addition of salt, sulphate of copper, and mercury, it is spread about a foot deep in paved courts, or "patios," 30 to 100 feet square. Here it is stirred for several weeks by the tramping of horses or mules, so that the silver will combine with the quicksilver. When this combination is effected the dirt is washed off and the heavy amalgam remains. The latter is collected and the silver and mercury are easily separated.

Gold occurs under various conditions. The principal source has been in connection with the silver ores, but placer deposits are worked in the states of Sonora and Guerrero. Large veins of gold-bearing quartz exist, and although they are mostly of low value, eventually they will add greatly to the output. The group of mines in and near El Oro, in the State of Mexico, is one of the largest gold camps in America, with an output

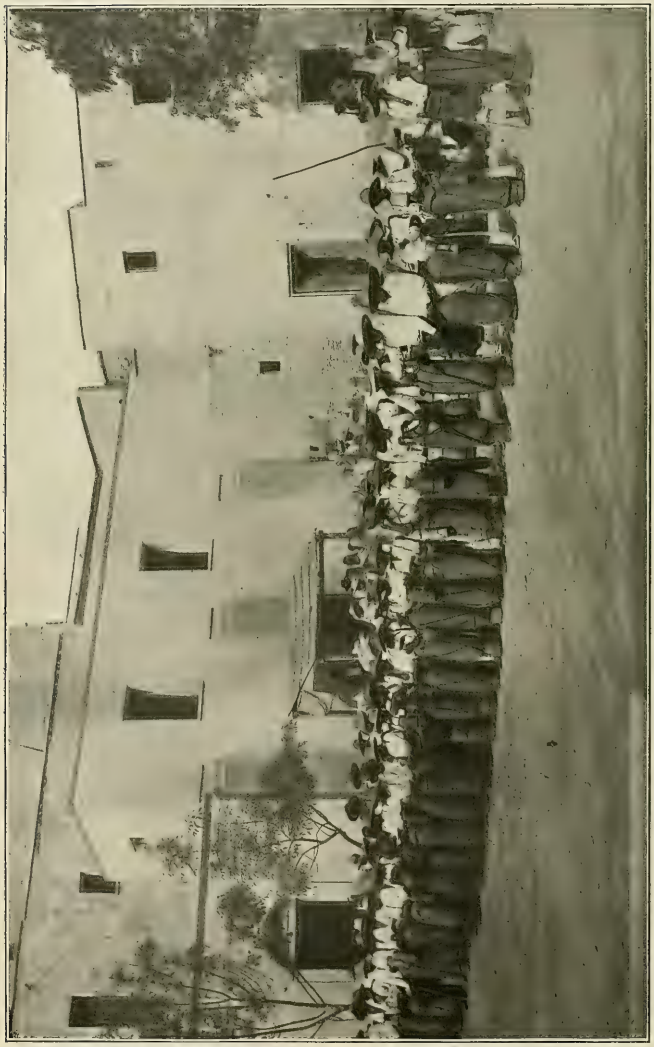
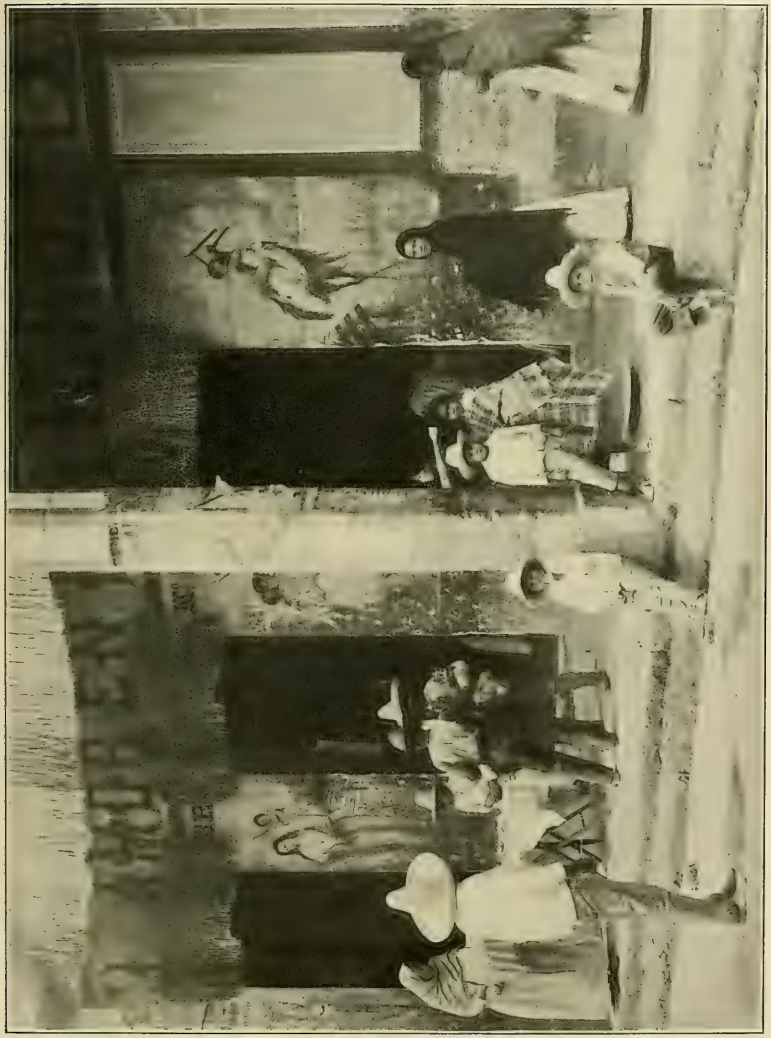


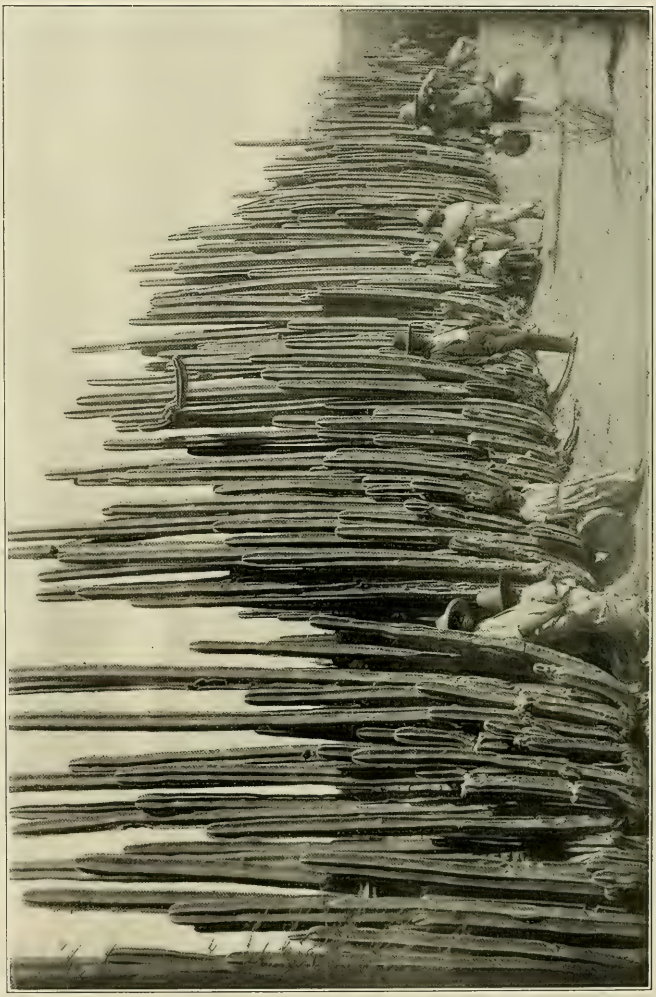
Photo from Mrs Alexander Graham Bell

Water Carriers at the Fountain—Guanajuato



A Pulque Shop

Photo from Graham Ker



Organ Cactus—Mexico

Waiting the Judgment Day, in the Cemetery, Mexico City

The Yucca, or Spanish Bayonet, Native of the Plains of the Ser

Photo from Mrs Alexander Graham Bell

Boy Drawing Pulque, the Common Drink of Mexico

Photo from Graham Ker

A Mexican Senorita

in 1906 of over $12,000,000 (Mexican), of which 80 per cent is gold.

Some of the Mexican mines pay remarkable dividends. The Dos Estrellas, in the El Oro district, has recently been paying over a million dollars a year on a capital of $300,000, and it is claimed that the Penoles mine has paid nearly 4 millions on $125,000 capitalization. The Real del Monte, near Pachuca, has distributed over 3 millions to holders of 2,554 shares. The total dividends of 22 prominent paying mines of silver, gold, and copper in 1905-1906 were more than 31 million dollars. The Department of Fomento has estimated that up to 1881 the total production of precious metals in Mexico had a coinage value of $4,553,859,113.

Copper mining in Mexico is rapidly growing in importance, as the figures given on a previous page will show. In 1906 she produced about one-twelfth of the copper of the world, or nearly one-seventh as much as the United States. The mines are mainly in the states of Sonora and Lower California, a southward continuation of the great copper-bearing zone of the southwestern United States. About 11 mines are reputed to produce over a million pounds each a year. It is claimed that the Cananea camp will increase its production this year to six million pounds a month, as a result of a combination of several mines and increased facilities for mining. Increased developments in Guerrero, at Boleo, at Jimulco, at Panuco, and in Zacatecas, Coahuila, Puebla, and Michoacan will add greatly to the future output. The mines at Cananea rank seventh among the leading copper mines in the world. Most of the copper ores range from 3 to 40 per cent of copper and they often carry gold and silver. Many of the deposits, especially those of moderate richness, are thick, numerous, and have great length.

ABUNDANCE OF IRON

The iron industry is growing steadily, and eventually can supply all Mexican needs and probably furnish products for export. At the famous "Iron Mountain" in Durango, the ore body is over a mile long, one-third of a mile wide, and rises 200 to 400 feet above the surrounding plain. The ore body is split by a great intrusive dike, but there are over 360 million tons in sight and much of it reaches 60 per cent in iron content. The two great deposits operated for the furnaces at Monterey are 79 and 120 feet wide and rise in a ridge several hundred feet high. Steel rails and structural iron are now being produced at this place. There are many other large deposits in the Republic, but some of them are too remote from fuel to be valuable under present conditions.

Lead from Mexico has a value of $8,000,000 to $10,000,000 a year and much of it is a by-product of silver smelting.

Zinc is constantly gaining in importance as a mineral resource, and this metal and graphite, antimony, and mercury have an aggregate value of several million dollars a year.

The mining laws of Mexico have been improved from time to time, until now, with some recent changes, the conditions are even more favorable and encouraging than they are in the United States. Foreign investments are amply protected, especially if they are legitimate ones. There are various taxes on mining properties and output and an export duty on silver. The taxes are thought to be too heavy by some of the companies, but it is believed that probably they will be reduced eventually, so that they will not be burdensome.

Labor is somewhat scarce in parts of Mexico, which is a serious handicap to the development of mines and other resources. In order to better this condition, the government is encouraging immigration, and it is expected that soon more laborers will be available. Most labor in Mexico is furnished by the half-breeds and Indians, many of whom are not very efficient, according to northern standards. They work for long hours and low pay, but require many holidays and other vacations. They

Photo from Graham Ker

The Public Laundry

Market Scene in Colima, Mexico

Photo from Graham Ker

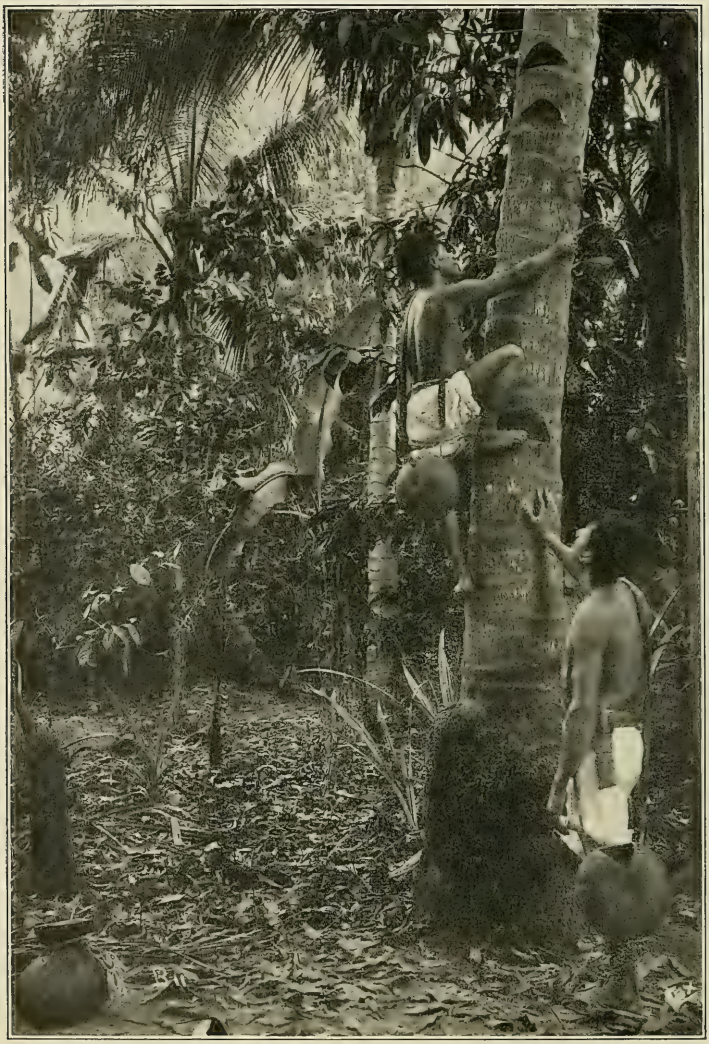


Photo from Graham Ker

Going After Cocoanut Milk

A Mexican Senor

Photo from Graham Ker

Drying Coffee on a Large Mexican Plantation Photo from Mrs Alexander Graham Bell

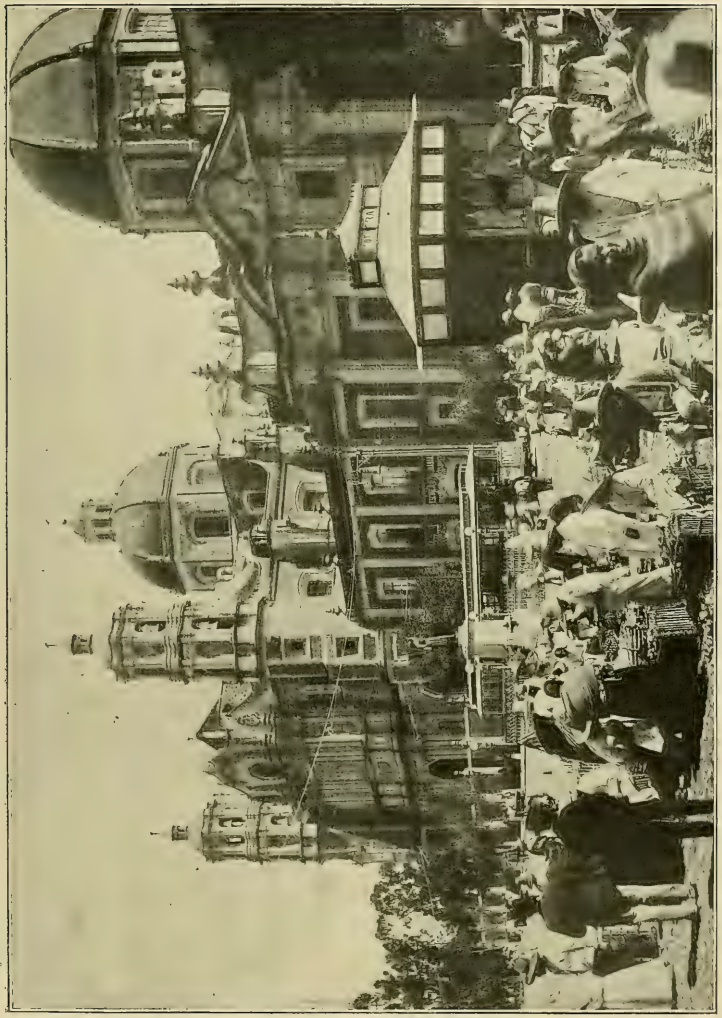


Photo from Graham Ker

Guadalupe Hidalgo

Photo from Graham Ker

A Girl from Yucatan

Photo from Graham Ker

Tehuana Indian Girl

Photo from Consul E. H. Thompson, Yucatan

Types of Mestizos (White Father and Indian Mother), Yucatan

Sacrificial Stone

Photo from Graham Ker

At a time when most of Europe was in utter darkness, when the "Parisii" lived in caves and the Gauls in "wattled huts," the priests and rulers of Yucatan lived in stone temples and palaces

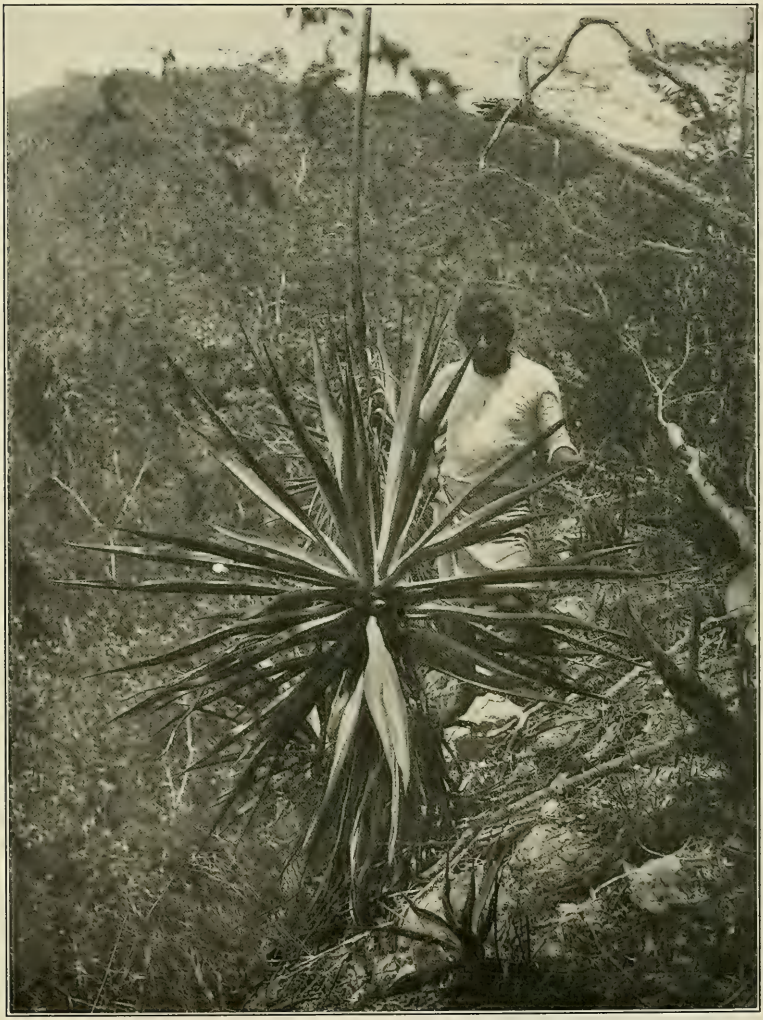


Photo from Consul E. H. Thompson, Yucatan

A Wild Agave Plant—Yucatan

This plant has made Yucatan one of the richest states of Mexico. From it the sisal fiber is obtained, which is used for sacking cordage and binders' twine. Yucatan exports about $13,000,000 worth of the fiber to the United States annually

excel in mining and do well in dealing with live stock.

In recent years the total commerce of Mexico, comprising imports and exports, has amounted to about 180 millions (gold), and it has had a steady growth to about six times its amount 20 years ago. The exports have an approximate value of 100 millions (gold), or about 4 times the amount 20 years ago. The approximate value of exports to the United States is 65 millions (gold). About 60 per cent of the exports are mineral products. Henequen and other fibers are over 18 per cent (over 18 million dollars, gold); coffee, 5 per cent; cattle and other live stock, 3½ per cent; hides, 3½ per cent; wood and dyewoods, 1½ per cent; cocoa, 1½ per cent; rubber and tobacco, 1 per cent each; chicle and vanilla, 1½ per cent.

AGRICULTURAL RESOURCES

I have not given any special attention to agricultural conditions in Mexico, but many facts are available which indicate plainly that the products of vegetable growth will eventually be the source of greatest income and prosperity, for they will be everlasting. A large percentage of the population are agriculturists, and while a considerable acreage is cultivated, it is a small proportion of the area of the Republic. Further expansion of the industry will depend in large measure on colonists and irrigation. Present production is greatest in the lowlands, where there is a constant high temperature and abundant rainfall. In this region grow a great variety of tropical plants which are the source of large income to the Republic. The fiber plants, which flourish in the lowlands, rank highest in value, notably the henequen fiber, a variety of hemp, which has been exported from Yucatan to a value of 300 million dollars in the last 25 years. It is reported that the exports of this material from the port of Progresso in 1906 had a declared value of 26 million dollars (Mexican); a large part of it comes to the United States.

Cotton is an important Mexican product, but the amount raised has not been sufficient for home consumption. The yearly crop is valued at nearly 10 million dollars (Mexican), and about 2 million dollars' worth additional is imported from the United States. The extent of the industry is indicated by the fact that more capital is invested in cotton mills than in any other single manufacture in the country. The principal production is in Coahuila and Durango, but the plant is raised in other states also. It is certain that the cultivation could be greatly increased, for extensive areas are either suited to cotton at present or could be made available by irrigation.

Corn and wheat are important crops in the higher regions, between altitudes of 6,000 and 9,000 feet, and while their gross value is over 125 million dollars they do not fully supply the local demand. It is believed that a very large area is suitable for the growth of cereals, especially with the aid of irrigation, so that eventually they will be important items of export.

Coffee production, which at present has a value of about 3 million dollars, is likely to increase very greatly, for many areas are suited to the growth of the plant and Mexican coffee is rapidly gaining favor in the market. The same statements may be made regarding tobacco and cocoa. The sugar product is valued at 25 million dollars a year, not counting the rum which is distilled. Undoubtedly sugar-beets will thrive in portions of Mexico and can be made an important resource.

Rubber has long been one of the minor products of the lowlands of Mexico, and many new plantations have been started in the past few years. As about 10 years are required for the development of the trees, the new projects have not added greatly to the output. It is stated that about 50 companies have set out 25 million trees. These are planted about 650 to the acre. In the past two years a large amount of rubber has been produced from a shrub known as guayule. The value of this product in 1906 was nearly one million dollars in gold.

Photo from Consul E. H. Thompson, Yucatan

A Native Maya Indian of Pure Blood, Yucatan

Mexico has very extensive water-power possibilities. The many streams rising in the highlands of the central area fall rapidly in the region of steep slopes descending to the lowlands. A fall of 200 to 500 feet to the mile is frequent. Some of this power is now utilized and transmitted as electricity to various mills and cities. Soon 50,000 horse-power will be carried to the federal district and 30,000 horse-power to Guadalajara. Several plants now furnish electricity to mines.

Irrigation has been practiced in Mexico for many centuries, but on a relatively restricted scale and usually in places where the engineering difficulties have not been great. Large water supplies remain to be utilized, and when suitable reservoirs and ditches are constructed, there can be reclaimed an acreage comparable to that which is now being provided by our own Reclamation Service. Under the favorable conditions of mild climate and rich soil, the products of irrigation will be very valuable. It is safe to predict that the water that can be used in this manner will prove to be one of Mexico's most important resources.

Underground waters are also a resource that will be found of increasing value for stock, domestic use, and irrigation. In many portions of the Republic the geologic structure is favorable for artesian and other wells which eventually will be sunk. There are a few flowing wells at various points and they furnish a portion of the supply for the federal district.

Many sections of Mexico were well forested originally, but large areas have been devastated, especially near the cities and mines and in connection with some kinds of agriculture. The government has taken the matter in hand and created two large forest reserves. Many valuable timber trees grow in the Republic and now are a source of large income. There are good prospects for the future of the lumber industry when reforesting is effected and the forests are placed under suitable control.

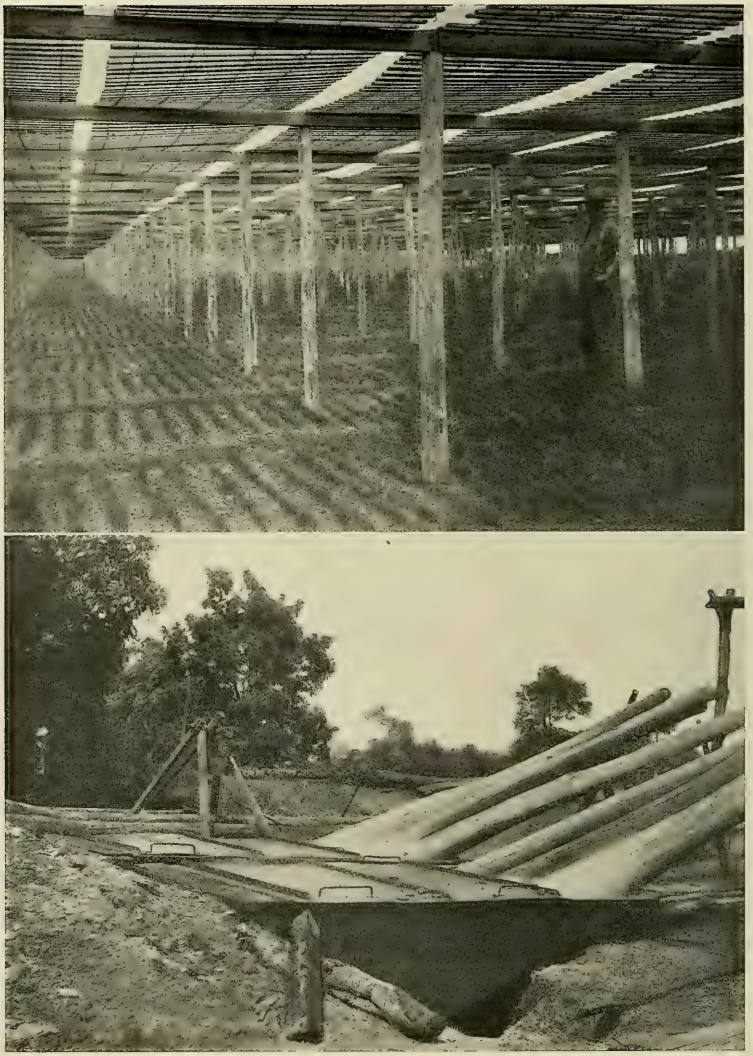
Live stock has always been one of Mexico's most valuable resources and at present is estimated to have a total value of about 125 million dollars (Mexican). Over two-thirds of this is cattle, with the remainder horses, mules, sheep, goats, hogs, and asses. There are wide cattle ranges now largely utilized, but if water were obtained by dams or wells, extensive additional areas could be made available in northern Mexico. Meat is a much more important food element in Mexico than is generally supposed and home consumption is large. Formerly most Mexican cattle were of low grade, but of late a large amount of high-class breeding stock has been imported with the view of raising the standard. By this means much better markets can be secured and the industry placed on a more profitable basis.

SAVING THE FORESTS*

By Herbert A. Smith, Editor of the Forest Service

UNCLE SAM, who is the largest landowner in the world, is the third largest timberland owner. The forests of the Russian government reach the enormous total of nearly 600,000,000 acres. This is almost equal to all the forests in the United States, public and private. In Canada the Dominion government holds about 180,000,000 acres of commercial timberland. Our own national forests now contain over 150,000,000 acres—an area equivalent to all the Atlantic states from Maine to Virginia, inclusive, and

* A description of the work of the U. S. Forest Service, which has charge of government resources valued at $1,500,000,000



Photos from U. S. Forest Service

A Nursery of Bull Pine Seedlings Two Months Old

Tanks for treating telephone poles with preservatives. One of the principal offices of the U. S. Forest Service is coöperating with railroad and telephone companies to obtain better methods of preserving timber

Photos from U. S. Forest Service

A Middle-aged Forest of Norway Spruce, Owned by the Austrian Government

An Illustration of Overgrazing

Photo from U. S. Forest Service

The sheep sweep the land as clean as a prairie fire

a large part of West Virginia. In this are included two forests, aggregating about 5,000,000 acres, in Alaska, and one of 66,000 acres in Porto Rico. Hawaii and the Philippines also have forest reserves, and the forested public lands in the Philippines are supposed to amount to over 50,000,000 acres; but in both of these cases the land belongs, not to the United States, but to the insular governments. If it were a question not of government ownership, but of total timbered area, the United States would stand next to Russia.

How much unreserved timberland the government owns it is impossible to say. Outside of Alaska, however, the total is unimportant in comparison with the national forests. More complete knowledge will doubtless bring to light more or less which should be added to the present forests. On the other hand, these forests now include many interior holdings and claims. Their area is subject to still further future reduction by the location of new mining claims and the exclusion of land found to be agricultural. It is no part of the government policy to try to grow trees on land which can be used to better advantage in other ways; so wherever the prospector can find paying mineral and the homesteader can find land worth farming permanently the national forest gives way.

It must also be remembered that by no means all the land in these forests is forested. In many cases the unforested condition is temporary; the original growth has been swept away, usually by fire, but can and will be brought back in time. But a good deal of the land can never grow anything. The national forests lie mainly upon the mountain ranges of the West. As these rise to alpine altitudes, the timber is left behind, and a point is reached where there is only bare rock and perpetual snow.

No exact statement can be made, either as to the amount of barren land in the national forests or as to the deduction which should be made for alienations within them. Perhaps one-twentieth would be a fair allowance for the first and one-tenth for the second. It seems improbable that any future action to enlarge the number or size of the national forests in the West will more than offset the eliminations which the recognition of private titles will work.

Thus the nation is likely to have in hand eventually, as the final fruits of the policy of putting into national forests suitable portions of the public lands, from 120,000,000 to 130,000,000 acres of actual forest.

THE DEVELOPMENT OF OUR NATIONAL FOREST POLICY

This policy had its beginnings in the act of March 3, 1891, when Congress empowered the President to "set apart and reserve, in any state or territory having public lands bearing forests, any part of the public lands wholly or in part covered with timber or undergrowth, whether of commercial value or not, as public reservations." Under this act there were created in the next three years reserves which totaled 18,000,000 acres. These reservations, however, were merely withdrawn from settlement and the location of claims; but practically no provision was made for their protection or use. The United States had rather drifted than been guided into the ownership of forest reserves and had little idea what to do with them. Few people knew that there were any such things.

In February, 1896, when the second Cleveland administration was drawing toward its end, the Secretary of the Interior, Hon. Hoke Smith, requested the National Academy of Sciences to make an investigation and report upon "the inauguration of a rational forest policy for the forested lands of the United States." The result was the appointment of a committee of seven, which, after some months of study and examination of western forest conditions, recommended the creation of 11 new reserves, containing in all more than 21,000,000 acres. On February 22, 1897, these reserves were proclaimed by President Cleveland.

The general public was taken wholly

by surprise by this action, which it was ill prepared to understand. It was commonly thought in the West that the effect of the proclamation was to put these lands under the ban of an executive interdict against use, and that they were to be held by the nation as vacant and idle wilderness.

But during the next few months public opinion concerning the reserves underwent a remarkable change. Their true purpose and their real value were recognized. Congress had, by the act of June 4, 1897, helped clear the air by laying down as a guiding policy for the administration of all forest reserves, that they should exist only "to improve and protect the forest within the reservation, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States; but it is not the purpose or intent of these provisions, or of the act providing for such reservations, to authorize the inclusion therein of lands more valuable for the mineral therein, or for agricultural purposes, than for forest purposes." The same act required the Secretary of the Interior to protect the forests against fire and depredations and empowered him to make such regulations for their use and preservation as should be necessary to carry out the objects for which they existed. Thus was definitely formulated the policy which has since guided the executive branch of the government in its administration of the reserves, or national forests, as they are now officially designated.

From that time on the area of the reserves grew apace. President McKinley increased the total from 39,000,000 to 46,000,000 acres. By July, 1904, the total had risen to 63,000,000 acres; by July, 1906, to 107,000,000 acres, and during the last twelve months there have been added 44,000,000 acres more. Thus has been brought substantially to realization the recommendation of the committee of seven, that "all public lands of the United States more valuable for the production of timber than for agriculture or mining shall be withdrawn from sale, settlement, and other disposition and held for the growth and sale of timber."

OUR NATIONAL FORESTS WILL SOON BE SELF-SUPPORTING

In economic usefulness the forests increase their importance almost day by day. Their value to the country is to be measured not by the income which they furnish, but by their contributions to the material welfare of the West; but some idea of the growing use of the national forests may be gained from the fact that receipts from timber sales for the fiscal year 1906-07 were about $600,000, as against less than $250,000 for the preceding year and less than $86,000 for 1904-05. The receipts from grazing, 1906-07, were $875,000. In the year ending June 30, 1904, the national forests yielded a total revenue of $60,000; in the past year, 1906-07, $1,600,000. It is believed that by 1910 the receipts from the national forests will be equal to the appropriations for the forest service.

As years go by it will become increasingly evident that the permanent prosperity of the entire West has been at stake in the forest-reserve question. With the upbuilding of the country through settlement and the rapid rise in the value of timber consequent upon an ever-growing demand, coupled with a fast-dwindling supply, the forested public lands have melted away like snow in spring. In 1905 leadership in the quantity of lumber produced passed for the first time to a Pacific Coast state. The output of the mills of Washington and Oregon now enters the New York market. Within fifteen years the present stand of southern pine will have succumbed to the saw, after which fifteen years more is likely to finish the far western supply. The Lake states have nearly completed their virgin cut, under methods so suicidal that sandy wastes of worthless brush have been substituted for what might have been well-

stocked young pine forest coming on to take the place of what was cut off.

The situation is so plain now that he who runs—or rides in the Pullman—may read. But had it been necessary to wait until the facts themselves spoke clear to the public understanding, the time for effective action in the West would have passed. Sooner or later the logic of events was bound to point out the right path, but it would have led up to a closed door. There is almost no good timber outside of the national forests which has not passed into private ownership. Would-be locators under the timber and stone act in the far northwest are now hunting down and filing on forty-acre lots—a thing hitherto unheard of. Had the making of reserves been deferred until now, there would be little of value left to reserve.

That the lumber industry, now one of the chief industries of the West, must perish with the exhaustion of the timber supply needs no argument; and private lumbering in the West is making virtually no attempt to prevent exhaustion by the use of methods to secure a future timber crop from cut-over lands. But the economic importance of the forests is far more fundamental than merely the support of the lumber industry, or even the supply of building material, to say nothing of material for the various wood-working industries. Houses can be made of brick, stone, concrete, and iron, but not mine props, nor even railroad ties, with any practical success, as yet, at least. If fire and the ax (or the saw, to be more exact, since the lumberman cannot now usually afford to waste good sawlog material in chips) were allowed to continue their work uncontrolled by government action, future mining development would begin to face an obstacle which would grow increasingly difficult to overcome. It is not too much to say that forest preservation in such regions as the Black Hills and the Montana copper district is of vital moment for the future of the mines. Somes of the great railroad systems of the West are already drawing heavily upon the national forests for ties. The supply of fence-posts for the farmer is a smaller, yet important, function of the forest.

THE USE OF THE NATIONAL FORESTS

As yet, however, the use of the national forests as sources of timber supply has hardly begun. In most regions there is still plenty of uncut timber in the hands of private owners. It would be the height of unwisdom for the government to enter into competition with this timber for the market, so long as the public can obtain it at a reasonable price, when a future demand is certain. Undoubtedly the day will come when the necessities of the public will put great pressure upon the national forest administration to sell the timber faster than it will grow, and it remains to be seen whether under these conditions it will be possible to prevent overconsumption. For the present, however, the fact that the national forests are still largely surrounded by more accessible timber belonging to private owners prevents their extensive utilization. In a sense, this involves a loss for the time being of their productive power; for unless mature timber is cut, production is at a standstill, growth merely balancing decay, whereas a well-managed forest is never idle, but always increasing in volume of timber up to the time of harvest. Yet the timber in the national forests is steadily increasing in value, even if not in quantity, from the rise in lumber prices; and this means that its capacity for public usefulness is increasing also.

Essentially the national forests should be thought of as undeveloped property of great potential value, but needing also large expenditures on capital account before their productive power can be fully utilized. Efficient forest management—or, in other words, working a forest for all it is worth—requires, for one thing, good means of transportation. With a well-planned system of permanent roads, logging can be carried on in whatever part of the forest is most ready for it.

Again, protection of the forest against fire and trespass calls for means of getting rapidly about and of intercommunication on the part of the members of the protective force. Rangers' cabins, tools, and other equipment are also matters of necessity. The Forest Service is doing all that it can to make these permanent improvements on the national forests. Roads and trails are being built, telephone lines run, and quarters for the field force provided. The telephone has proved especially effective as an aid in controlling fire. There are now under construction nearly 2,000 miles of telephone lines and 1,800 miles of trail. A special appropriation of $500,000, made by Congress for use in these improvements, enables the work to be pushed. Much of the money paid out by the Forest Service as general expenses should really be classed as expenditure for permanent improvements—in other words, is reinvested. This kind of development is good business, for it is increasing the value and serviceableness of the property. When put into roads, it also helps materially the general development of the region, since the roads are open to the public.

PRESENT CAPITALIZED VALUE OF THE NATIONAL FORESTS

An estimate of the present capital value of the national forests was submitted by the Forester to the Agricultural Committee of Congress last winter. It was as follows:

1. Stumpage value of 330 billion feet of timber at $2 per M..	$660,000,000
2. 110 million acres capable of producing commercial forest, at $1 per acre.....	110,000,000
3. 110 million acres of range for grazing live stock, at 1½ cents per acre (capitalized at 5 per cent).....	30,000,000
4. 83 million acre-feet of water for irrigation purposes, at 10 cents per acre-foot (capitalized at 5 per cent).....	166,000,000
5. Three million horse-power, capable of being developed from water in reserves, at $10 per horse-power (capitalized at 5 per cent).....	600,000,000
6. Estimated value of occupancy and use of reserve land, products, and resources additional to the above.....	5,000,000
7. Permanent improvements now on the reserves (roads, trails, cabins, telephones, etc.)....	5,000,000
Total	$1,576,000,000
Less 10 per cent for private holdings	157,600,000
	$1,418,400,000

This table does not mean that the forests are to be regarded as a corporation would regard a similar piece of property held by it, and run for the sake of the money return. They are maintained and managed not in order to make them yield the largest possible income, but in order to make them contribute most fully to the economic welfare of the public. Uncle Sam has not turned landlord, looking upon his broad acres as primarily revenue-producers and seeking to squeeze out of them all they will bring in. The very moderate charges made for the use of land for grazing, and proposed for the use of land in order to develop and sell hydraulic power, by no means represent the actual value of what the user gets, and gets for an *exclusive* use. The value of the use privilege depends upon the protection which administration by the Forest Service gives, and which is a source of expense to the government. It is a privilege which other users would be glad to pay for. Why should not the beneficiaries of the forests contribute toward the cost of maintaining them?

THE SALE OF GRAZING RIGHTS IN THE FORESTS

At present the receipts from the grazing fee, amounting to $875,000 for the year ending June 30, 1907, constitute the largest single item in the income derived by the government from the national forests. This is because, unlike their use for timber supply, the use of the forests for stock is fully developed. Many re-

gions indeed were overgrazed when the Forest Service first undertook, in 1906, to regulate the grazing and collect the fee. In other regions there is still room for more stock than has applied.

Overgrazing brings deterioration of the range through the injury done the forage plants, which are cropped too close, trampled, or otherwise injured. Naturally its effects are cumulative. By reducing the number of stock allowed on the range, opportunity has been given for recuperation; so that instead of supporting less and less stock, the range is now supporting more than last year. Each herd of cattle or band of sheep is assigned to a particular locality; but the charge is made per head, not per acre, and the number of head allowed is fixed. The result has been to prevent friction between rival stockmen, to give stability to the industry, and to increase the weight and market value of the stock as a result of the improved range conditions. In most of the West the stockmen are glad to accept the measures of regulation and recognize that they are themselves gainers.

If the amount of stock for which grazing permits are sought exceeds the number fixed as the maximum in any one district, first preference is given to settlers, small owners, and those living nearest by. Previous use of the range is also a ground of preference. Thus the first right is given to those who are making homes and helping to develop the country along permanent lines.

From parts of the forests where a young growth of trees is springing up which is valuable for forest renewals, grazing is rigidly excluded. With this limitation and with the prohibition of overgrazing, utilization of the forage crop, which in most of the West abounds within the forest, is safe, wise, and profitable. More than one million cattle and horses and nearly six million sheep and goats were grazed in the forests last season. Through the support which they give to the stock industry, the national forests make one of their largest returns to the economic life of the West.

The Forest Service is now prosecuting investigations to find out how the range may be bettered through modifying the present methods of handling the stock or through introducing new grasses. With forage plants as with trees, man's use without regard to the effect which follows is very apt to produce unfavorable changes in the kinds of plants which reproduce themselves. It is not improbable that by studying and taking advantage of the natural habits of the various species the range within the national forests can be brought to improve itself materially, thus increasing still further its carrying power and value to the West.

THE MOST IMPORTANT PRODUCT OF THE FORESTS

But of the three major products which the forests of the West contribute to man's use—wood, forage, and water—the last is by far the most important.

Upon the mountain slopes of the national forests head the streams which, emerging from the mountains, are diverted into the ranchers' ditches and turn the brown of the desert to vivid green. These mountain slopes should remain forever forested. Once bared, their early-melting snows and summer rains will pour into the rivers like water from a roof. Comparative measurements of stream discharge from forested and unforested basins alike in all other respects have been made in the West by the U. S. Geological Survey. They show sudden floods followed by low water in the former case, a relatively equalized flow in the latter. Neither the West nor the country can afford to suffer the monumental waste which forest denudation would mean.

Many millions of dollars are now invested in national reclamation work. It is recognized that forestry is as necessary to the success of this noble and colossal plan to make fertile the desert as the dams and reservoirs which supplement Nature's storage. When the forests are stripped from the mountains the streams become silt-laden, and the builders of many a costly dam have seen their

Location, Date of Latest Proclamation, and Area of the National Forests in the United States, Alaska, and Porto Rico

State.	Forest.	Date of latest proclamation.	Area.	Total.
			Acres.	
Arizona	Baboquivari	Nov. 5, 1906	126,720	
	Black Mesa	June 30, 1906	2,030,240	
	Chiricahua	Nov. 5, 1906	287,520	
	Dragoon	May 25, 1907	67,200	
	Grand Canyon[1]	Aug. 8, 1906	2,257,920	
	Huachuca	Nov. 6, 1906	314,125	
	Mount Graham	July 22, 1902*	140,880	
	Pinal Mountains	Mar. 20, 1905	45,760	
	Prescott	Oct. 21, 1899	423,680	
	San Francisco Mountains	Apr. 12, 1902	1,975,310	
	Santa Catalina	July 2, 1902	155,520	
	Santa Rita	Apr. 11, 1902	496,100	
	Tonto	Oct. 3, 1905	1,115,200	
	Tumacacori	Nov. 7, 1906	203,550	
				9,422,125
California	Diamond Mountain	Oct. 15, 1906	650,097	
	Inyo	May 25, 1907	214,400	
	Klamath	May 6, 1905	1,896,313	
	Lassen Peak	June 2, 1905	897,115	
	Modoc	Nov. 29, 1904	288,218	
	Monterey	June 25, 1906	335,195	
	Pinnacles	July 18, 1906	14,108	
	Plumas	Mar. 27, 1905	785,620	
	San Bernardino	Feb. 25, 1893*	737,120	
	San Gabriel	Dec. 20, 1892*	555,395	
	San Jacinto	Feb. 14, 1907	1,751,439	
	San Luis Obispo	June 25, 1906	363,350	
	Santa Barbara	Oct. 3, 1906	1,982,100	
	Shasta	Sept. 24, 1906	1,523,770	
	Sierra	July 25, 1905†	5,049,934	
	Stanislaus	Sept. 7, 1906	1,296,800	
	Stony Creek	Feb. 6, 1907	883,405	
	Tahoe[2]	Sept. 17, 1906	1,394,772	
	Trabuco Canyon	Jan. 30, 1899	109,920	
	Trinity	Apr. 26, 1905	1,243,042	
	Warner Mountains	Nov. 29, 1904	306,518	
				22,278,631
Colorado	Battlement Mesa	June 5, 1905	797,720	
	Cochetopah	June 13, 1905	1,133,330	
	Fruita	Feb. 24, 1905	7,680	
	Gunnison	May 12, 1905	901,270	
	Holy Cross	Mar. 1, 1907	1,061,280	
	La Sal[3]	Jan. 25, 1906	29,502	
	Las Animas[4]	Mar. 1, 1907	196,140	
	Leadville	May 12, 1905	1,219,947	
	Medicine Bow[5]	Mar. 2, 1907	1,346,155	
	Montezuma	Mar. 2, 1907	1,612,746	
	Ouray	Feb. 2, 1907	273,175	
	Park Range	Mar. 1, 1907	1,133,686	
	Pikes Peak	May 12, 1905	1,681,667	
	San Isabel	June 12, 1905	321,227	
	San Juan	Mar. 2, 1907	2,203,918	
	Uncompahgre	Mar. 1, 1907	619,428	

State.	Forest.	Date of latest proclamation.	Area.	Total.
			Acres.	
Colorado	Wet Mountains	June 12, 1905	239,621	
	White River	May 21, 1904	970,880	
				15,748,772
Idaho	Bear River[6]	May 28, 1906	415,360	
	Bitter Root[7]	May 22, 1905	3,860,960	
	Big Hole[8]	Mar. 1, 1907	304,140	
	Caribou[9]	Jan. 15, 1907	733,000	
	Cabinet[10]	Mar. 2, 1907	494,560	
	Cassia	June 12, 1905	326,160	
	Cœur d'Alene	Nov. 6, 1906	2,331,280	
	Henrys Lake	May 23, 1905	798,720	
	Kootenai[11]	Nov. 5, 1906	165,242	
	Lemhi	Nov. 5, 1906	1,344,800	
	Palouse	Mar. 2, 1907	194,404	
	Payette	June 3, 1905	1,460,960	
	Port Neuf	Mar. 2, 1907	99,508	
	Pocatello	Sept. 5, 1903	49,920	
	Priest River[12]	Mar. 2, 1907	815,100	
	Raft River[13]	Nov. 5, 1906	293,044	
	Salmon River	Nov. 5, 1906	1,879,680	
	Sawtooth	Nov. 6, 1906	3,340,160	
	Weiser	Mar. 2, 1907	1,126,429	
	Yellowstone[14]	Mar. 2, 1907	303,000	
				20,336,427
Kansas	Garden City	July 25, 1905	97,280	
				97,280
Montana	Big Belt	Mar. 1, 1907	641,460	
	Big Hole[8]	Mar. 1, 1907	1,612,960	
	Bitter Root[7]	May 22, 1905	691,920	
	Cabinet[10]	Mar. 2, 1907	1,566,400	
	Crazy Mountains	Aug. 10, 1906	234,760	
	Elkhorn	May 12, 1905	186,240	
	Ekalaka	Nov. 5, 1906	33,808	
	Gallatin	Mar. 7, 1906	888,660	
	Helena	Apr. 12, 1906	782,160	
	Hell Gate	Sept. 14, 1906	1,582,400	
	Highwood Mountains	Dec. 12, 1903	45,080	
	Kootenai[11]	Nov. 5, 1906	887,360	
	Lewis and Clark	Mar. 2, 1907	5,541,180	
	Little Belt	Feb. 15, 1907	1,053,163	
	Lolo	Nov. 6, 1906	1,211,680	
	Long Pine	Sept. 24, 1906	111,445	
	Little Rockies	Mar. 2, 1907	31,000	
	Madison	Oct. 3, 1905	958,800	
	Missoula	Nov. 6, 1906	194,430	
	Otter	Mar. 2, 1907	590,720	
	Pryor Mountains	Nov. 6, 1906	78,720	
	Snowy Mountains	Nov. 5, 1906	126,080	
	Yellowstone[14]	Mar. 2, 1907	1,352,240	
				20,402,663
Nebraska	Dismal River	Apr. 16, 1902	85,123	
	Niobrara	Apr. 16, 1902	123,779	
	North Platte	Mar. 10, 1906	347,170	
				556,072

Nevada	Charleston	Nov. 5, 1906	149,165	
	Independence	Nov. 5, 1906	135,019	
	Monitor	Apr. 15, 1907	571,000	
	Ruby Mountains	May 3, 1906	423,660	
	Tahoe[2]	Sept. 17, 1906	59,115	
	Toiyabe	Mar. 1, 1907	625,040	
	Toquima	Apr. 15, 1907	386,000	
				2,248,999
New Mexico	Big Burros	Feb. 6, 1907	161,740	
	Gallinas	Nov. 5, 1906	78,532	
	Gila	July 21, 1905	2,823,900	
	Gaudalupe	Apr. 19, 1907	283,840	
	Jemez	Nov. 7, 1906	1,460,245	
	Lincoln	June 25, 1906	627,136	
	Las Animas[4]	Mar. 1, 1907	480	
	Magdalena	Nov. 5, 1906	153,900	
	Manzano	Nov. 6, 1906	459,726	
	Mount Taylor	Oct. 5, 1906	110,525	
	Pecos River	May 27, 1898*	430,880	
	Peloncillo	Nov. 5, 1906	178,977	
	Sacramento	Apr. 24, 1907	851,840	
	San Mateo	Nov. 5, 1906	424,663	
	Taos	Nov. 7, 1906	233,200	
				8,279,584
Oklahoma	Wichita[15]	May 29, 1906	60,800	
				60,800
Oregon	Ashland	Mar. 2, 1907	172,800	
	Blue Mountains	Mar. 2, 1907	3,603,920	
	Bull Run	June 17, 1892	142,080	
	Cascade	Mar. 2, 1907	5,886,840	
	Coquille	Mar. 2, 1907	148,317	
	Fremont	Sept. 17, 1906	1,235,720	
	Goose Lake	Aug. 21, 1906	630,000	
	Heppner	July 18, 1906	292,176	
	Imnaha	Mar. 1, 1907	1,750,240	
	Siskiyou	Mar. 1, 1907	1,132,582	
	Tillamook	Mar. 2, 1907	175,518	
	Umpqua	Mar. 2, 1907	798,400	
	Wenaha[16]	Mar. 1, 1907	494,942	
				16,463,535
South Dakota	Black Hills[17]	Sept. 19, 1898*†	1,163,160	
	Cave Hills	Mar. 5, 1904	23,360	
	Short Pine	July 22, 1905	19,040	
	Slim Buttes	Mar. 5, 1904	58,160	
				1,263,720
Utah	Aquarius	Oct. 23, 1903	639,000	
	Bear River[6]	May 28, 1906	267,920	
	Beaver	Jan. 24, 1906	285,930	
	Dixie	Sept. 25, 1905	465,920	
	Fillmore	May 19, 1906	399,600	
	Fish Lake	Jan. 22, 1906	264,320	
	Glenwood	Feb. 6, 1907	173,896	
	Grantsville	May 7, 1904	68,960	
	La Sal[3]	Jan. 25, 1906	128,960	
	Manti	Jan. 18, 1906	785,920	
	Monticello	Feb. 6, 1907	214,270	
	Payson	July 21, 1905	167,280	
	Raft River[13]	Nov. 5, 1906	117,203	
	Salt Lake	May 26, 1904	95,440	
	Sevier	Jan. 17, 1906	710,920	
	Uinta[18]	Oct. 6, 1906	2,187,550	
	Vernon	Apr. 24, 1906	68,800	
	Wasatch	Aug. 16, 1906	85,440	
				7,127,339
Washington	Colville	Mar. 1, 1907	869,520	
	Olympic	Mar. 2, 1907	1,594,560	
	Priest River[12]	Mar. 2, 1907	406,520	
	Rainier	Mar. 2, 1907	2,565,760	
	Washington	Mar. 2, 1907	6,310,740	
	Wenaha[16]	Mar. 1, 1907	318,400	
				12,065,500
Wyoming	Big Horn	Dec. 23, 1904	1,151,680	
	Bear Lodge	Mar. 1, 1907	136,784	
	Black Hills[17]	Sept. 19, 1898*†	46,440	
	Caribou[9]	Jan. 15, 1907	7,740	
	Crow Creek	Oct. 10, 1900*	56,320	
	Medicine Bow[5]	Mar. 2, 1907	583,364	
	Sierra Madre	Nov. 5, 1906	370,911	
	Uinta[18]	Oct. 6, 1906	4,596	
	Yellowstone[14]	Mar. 2. 1907	6,662,640	
				9,020,475
Total of 150 National Forests in the United States				142,972,855
Alaska	Afognak	Dec. 24, 1892	403,610	
	Alexander Archipelago	Aug. 20, 1902	4,506,240	
				4,909,880
Porto Rico	Luquillo	Jan. 17, 1903	65,950	
				65,950
Grand Total of 159 National Forests				150,819,105

[1] Game preserve created in the Grand Canyon National Forest by proclamation November 28, 1906.
[2] Total of Tahoe in California and Nevada = 1,453,887 acres.
[3] Total of La Sal in Colorado and Utah = 158,462 acres.
[4] Total of Las Animas in Colorado and New Mexico = 196,620 acres.
[5] Total of Medicine Bow in Colorado and Wyoming = 1,029,519 acres.
* Minor modification by Executive order since date listed.
† Minor modification by act of Congress since date listed.
[6] Total of Bear River in Idaho and Utah = 683,280 acres.
[7] Total of Bitter Root in Idaho and Montana = 4,552,880 acres.
[8] Total of Big Hole in Idaho and Montana = 1,917,100 acres.
[9] Total of Caribou in Idaho and Wyoming = 740,740 acres.
[10] Total of Cabinet in Idaho and Montana = 2,060,960 acres.
[11] Total of Kootenai in Idaho and Montana = 1,052,602 acres.
[12] Total of Priest River in Idaho and Washington = 1,221,620 acres.
[13] Total of Raft River in Idaho and Utah = 410,247 acres.
[14] Total of Yellowstone in Idaho, Montana, and Wyoming = 8,317,880 acres.
[15] Game preserve created in the Wichita National Forest by proclamation June 2, 1905.
[16] Total of Wenaha in Oregon and Washington = 813,342 acres.
[17] Total of Black Hills in South Dakota and Wyoming = 1,209,600 acres.
[18] Total of Uinta in Utah and Wyoming = 2,192,146 acres.

artificial lake fill up with worthless mud. The streams of the West are destined to play an important part in the upbuilding of industry and the supply of human needs through utilization as sources of power. This is particularly true in the Pacific Coast states. The Sierra Nevada and Cascade Mountains rise sharply to high altitudes and receive upon their western slopes a heavy rainfall. Thus almost ideal conditions are produced for power development. The streams of the Sierras light the city of Los Angeles, with its 200,000 inhabitants, and operate the electric railways which traverse its streets and spread their network out to the neighboring towns. The water wheels which generate this power and light are located within the national forests. So far as known, California has no good coal. A dense population is certain. The conservation of water power, the coal that does not waste away in the burning, is therefore vitally important.

Since the profits of the corporations which have secured control of these sources of power are large, and since they are users of land in the national forests and benefit by the system of forest protection which the government maintains, there is no apparent reason why they should not be required to contribute something toward the cost of administration. Their case is not comparable with that of the users of water for irrigation, which supports the farmer and home-maker. In no way can a national forest better serve the purpose for which it exists than by increasing the number of farmers and home-makers. Therefore the irrigator need fear no charge.

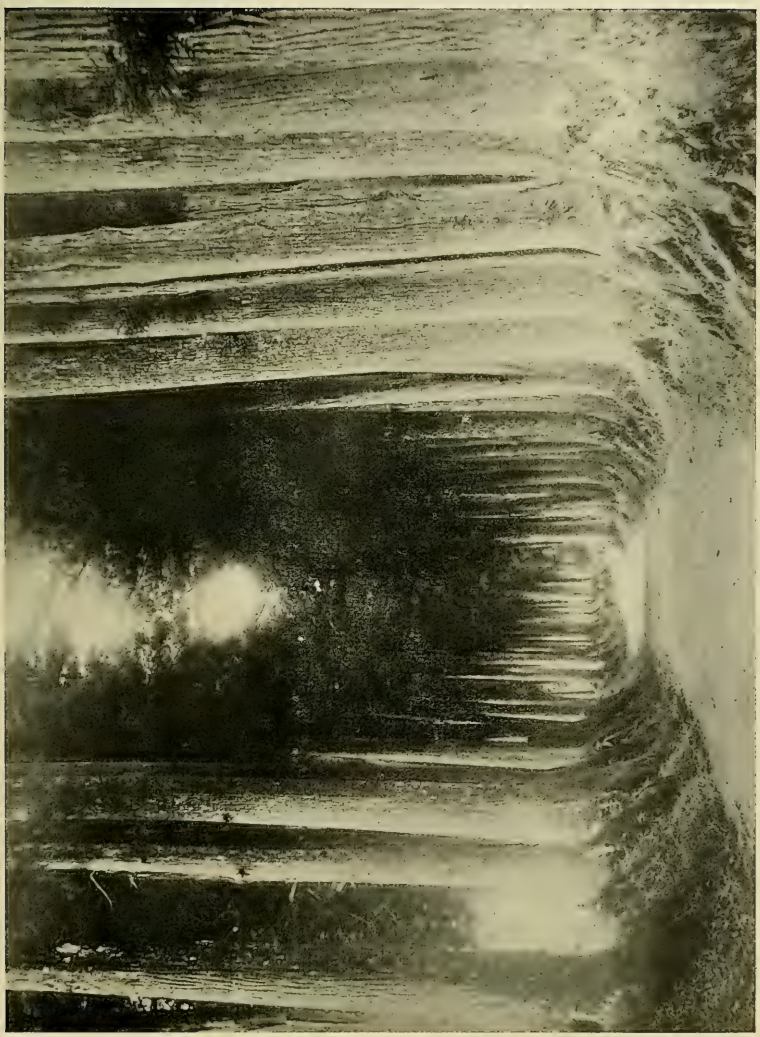
THE FORESTS OF EASTERN UNITED STATES ARE UNPROTECTED

As the years pass, the use of the national forests will constantly increase, and with this will increase also the recognition among the people of the entire country that saving the forests of the West though government ownership has been one of the greatest achievements of the present generation. This important work of constructive statesmanship has been participated in by presidents of both political parties and has proceeded along the lines laid down by Congress. It has brought us, and will in the future still more bring us, to realize that government action to secure the conservation of great natural resources which are threatened with wasteful dissipation is demanded in the public interest.

It still remains for us to work out some method for saving the forests of those parts of the East where essentially the same problem is presented as was met in the West. Since in the East there are no public lands belonging to the United States, a different method will have to be followed. To a large extent the problem is one which calls for action by the individual states.

Eventually it will be necessary in this country, as it has been necessary in Europe, for the states or the nation to own and manage a large part of the timber lands. Forestry received its first stimulus in Europe when it was perceived that in consequence of forest destruction the country was threatened with a dearth of fuel. The development of railway transportation, which made possible the general use of coal, came in the nick of time to avert this evil.

Meanwhile landowners had taken up the growing of timber extensively, and there is now a sufficient acreage of forest, public and private together, to produce each year as much wood as France consumes. But it has been found that the private owner does not care, and indeed cannot afford, to grow the larger sizes of timber. As compound interest rolls up against the original investment, the time comes when the yearly increment of wood ceases to add a value equal to the loss by the failure to realize. Private owners therefore manage their lands on short rotation periods. The result is that for some years in France, and other European countries as well, a scant supply of construction material must be faced. In no country does private forestry give any promise of being able to

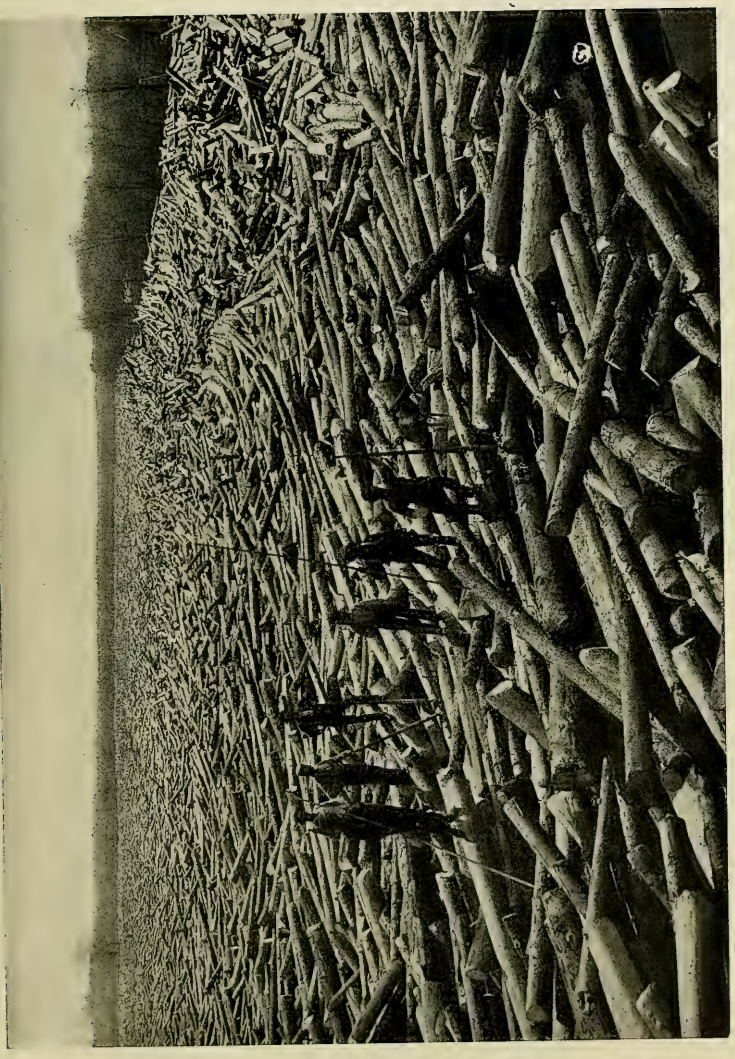


Cryptomeria Japonica

The avenue is fifty miles long and several hundred years old. Nikko, Japan

Photo from U. S. Forest Service

One-half of a Redwood Tree on the Way from the Forest to the Mill—Humboldt County, California



The Glens Falls Boom, Glens Falls, New York

Photo from U. S. Forest Service

supply the public need. The state, with its lower interest rate and freedom from taxes, can do what the private person cannot.

Three-fourths of the population of the United States is found east of the Mississippi River, but over half the timber is now west of it. Yet it is still from the forests of the East that the larger part of our timber is being drawn. Less than two decades will leave the East practically without saw timber of her own, unless it is possible to draw more heavily than present conditions permit upon the supplies of other regions. The demands even now laid by the lumber traffic upon the transcontinental lines from the Northwest have severely taxed their carrying powers. A very serious situation is in prospect.

Again, the East is the home of the hardwoods, or broad-leaved trees. These are used extensively in wood-working industries of many kinds. In these industries large amounts of capital are invested, and their products furnish a surprisingly large number of articles of daily use. Our virgin hardwood forests are so nearly cleared away that the collapse of the industries which they support is imminent.

There is every reason why what has happened in the mountains of the West should happen also in the mountains of the East. In the West, forests are needed to furnish wood and keep the streams running. In the East they are needed to furnish wood and keep back flood waters.

In certain regions, as in parts of the Southern Appalachians and in the White Mountains, the most serious effects of forest destruction fall mainly upon other states than those in which the destruction takes place. It is clearly too much to expect that Tennessee or New Hampshire should maintain forests to prevent floods, loss of water power, and impairment of navigation in Georgia or Massachusetts. In such cases purchase of lands by the federal government would seem to be the proper remedy. It is to be hoped that we shall soon see national forests created in these two important regions.

FLASHLIGHTS FROM THE JUNGLE

A few notes and illustrations from a remarkable book by C. G. Schillings, published by Doubleday, Page & Co., giving a record of hunting adventures and of studies in wild life in Equatorial East Africa.

MR C. G. SCHILLINGS is a wealthy young German who some years ago set out to photograph the big game of Equatorial East Africa. As a result of 10 years almost entirely devoted to the work, he has obtained and published the most wonderful series of photographs of the great animals of Africa in their native haunts that the world has seen. What makes his illustrations particularly valuable is the fact that they are of living animals and not of dead game, and that they are furthermore accompanied by an intelligent and keen description of the habits and characteristics of the beasts.

Mr Schillings greatly deplores the useless sacrifice of such a large number of magnificent elephants, lions, giraffes, rhinoceroses, etc., of Equatorial East Africa. In a few years this region, so recently the richest game country in the world, will be as depleted as South Africa or the United States.

The author gives many illustrations of the rapidity with which the big game is being swept away. In 1896, when he first went to that region, countless numbers of wild elephants roamed the forests and plains; today they are counted in tens where formerly they were counted by thousands.

A Great Bull Eland

Mr Schillings refers to the case of the late Dr Kolb, a German who came out to British East Africa in connection with a Utopian undertaking called "Freeland," and who, when his political scheme became impossible, applied himself to the reckless slaughter of the big game of British Africa. "In the course of two or three years he had slain, for no useful purpose whatever, one hundred and fifty rhinoceroses (a companion killed one hundred and forty more), each one being a far more interesting mammal than himself. At the end of this career of slaughter a rhinoceros killed him—perhaps appropriately."

The same is true of the giraffes, the lions, and practically all the larger animals.

He emphasizes the fact, however, that this extermination is wrought not so much by the sportsman as by the trader, and especially by large numbers of Africans who have been given guns and ammunition.

"I maintained rigorously the principle of keeping my caravan (in which I had never less than 130 men) upon a vegetable diet for the most part, allowing them meat only to a very small extent, and then merely as an adjunct to their meals. In the famine year of 1899 my provisions cost me more than 20,000 marks, which might have been brought down to a trifling sum had I taken heavier toll of the game, as the natives were always ready to barter vegetables for animals I had killed."

When the reader remembers that all expenses of Mr Schillings' expeditions were paid for out of his private means, this action on his part appears all the more commendable. He shot many animals, but brought home his specimens—40 lions, 35 leopards, large numbers of hyenas, jackals, and other beasts of prey, and many birds.

One can form no notion from seeing a stuffed giraffe or rhinoceros in a museum of the immense difficulties involved in the securing and preparing of such a specimen. When the animal has been shot and its skin carefully prepared, all the fat removed from it and every precaution taken against flaws, the skull and bones also having been cleaned separately, the collector has still to take immense pains about the transport to Europe. The weighty burden has to be carried on men's shoulders to the coast, along dangerous tracks, often through marshes and almost pathless thickets, and across streams and rivers. The ravages of insects and the damp atmosphere have to be fought against. There are long weeks of anxiety before the goal is reached.

All this trouble, to say nothing of the considerable expense, is involved in the bringing home in good condition of a single such specimen; but Mr Schillings has brought home quite a number of

Two Very Large Bull Elephants in a Virgin Forest to the West of Kilimanjaro

Their tusks weighed about 80 kilos apiece. This photograph was taken from a hill at a distance of about 300 paces, and should be held at arm's length. This series of pictures are by C. G. Schillings, and are republished from his book, "Flashlights from the Jungle," through the courtesy of Messrs Doubleday, Page & Co.

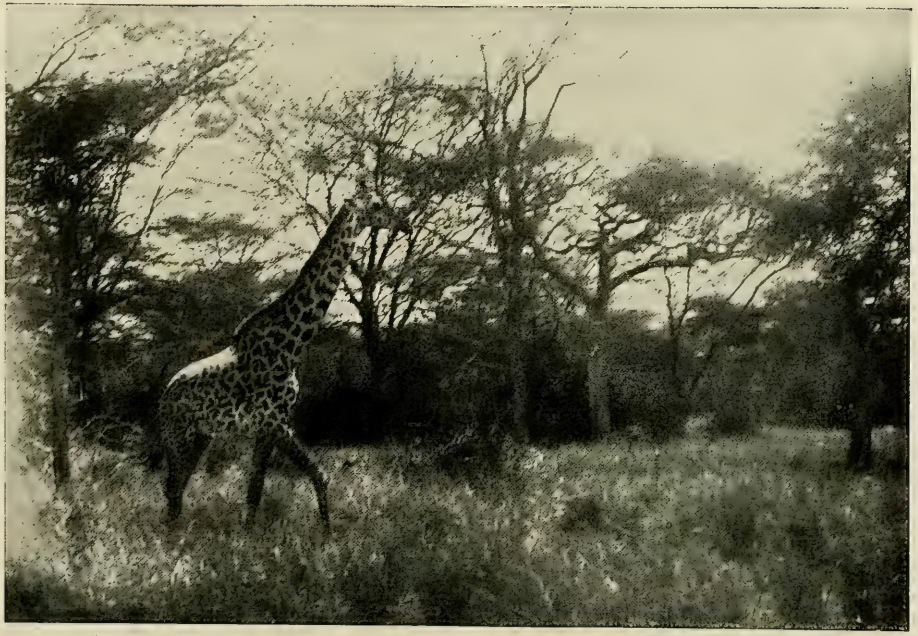
A Flashlight Photograph of Zebras Drinking at Night

Exceedingly difficult animals to photograph, owing to their excessive timidity and wariness

Some Specimens of Schillings' Giraffe in the Mimosa Woods
This is a new species discovered by Mr Schillings

A Herd of Zebras and Gnus

Gnus were to be seen in thousands roaming over the velt, while herds of a hundred zebras were not unusual



Schillings' Giraffe Passing the Hiding-place from which the Picture was Taken

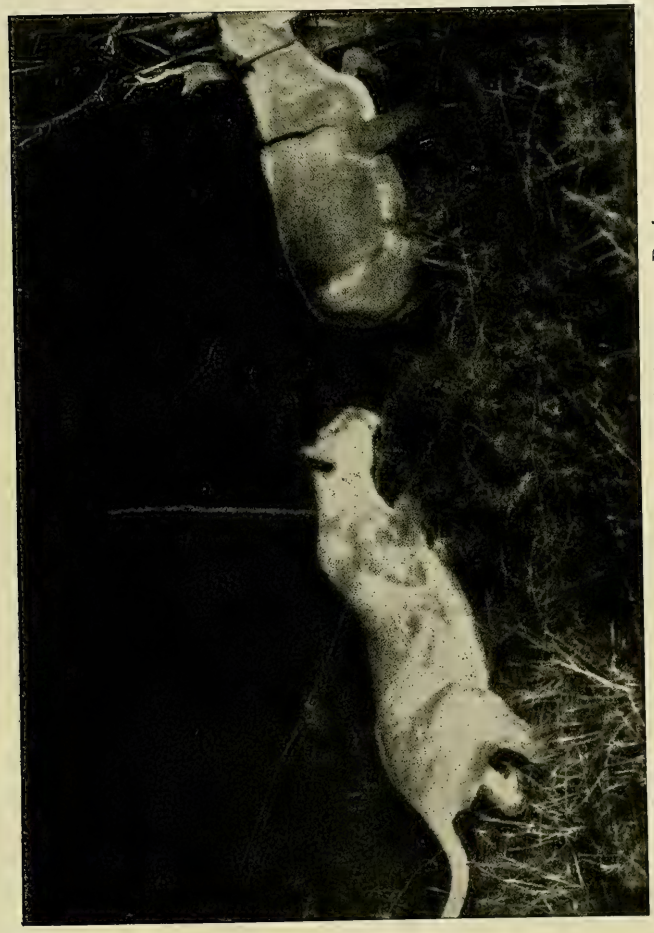
There is nothing attractive about a giraffe in captivity, owing to his gaunt skeleton appearance, due to lack of proper nourishment, but in the forest he is stately and handsome

A Flashlight of a Powerful and Full-grown Leopard, Taken at Midnight

Two Great Rhinoceroses Taking a Bath

A Cow Rhinoceros with its Young
Photographed by flashlight a few yards from the camera

Flashlight of a Maned Lion



Flashlight of a Lioness About to Spring upon a Donkey

giraffes, buffaloes, rhinoceroses, and elephants, a great number of large antelopes, and hundreds of hides and skins and skeletons of every description, all of them in such good condition that they are suitable for exhibition in museums.

"For days together I occupied myself exclusively with photography, getting any number of pictures and so managing that hundreds and hundreds of gnus and zebras hung around my camp almost like tame deer. Here they grazed, along with flocks of the beautiful crested cranes and Egyptian geese. Hundreds of Thomson's gazelle grazed like sheep among them, and wherever the eye turned it saw the rough, dark, strongly marked forms of the old gnu bulls as they grazed apart, cut off from the herds."

The chapter entitled "The Minds of Animals" contains some interesting observations. A young rhinoceros which the author captured and forwarded to Berlin "attached himself to me in a very few weeks, and got to distinguish quite clearly between the large number of men who came into touch with him, bearing himself quite differently with different individuals, just as he still singles me out from all the thousands who approach him now in the gardens in Berlin."

"Many other animals in this distant black country were to us a real source of enjoyment and consolation. Take, for example, my young elephant, who loved me with childlike simplicity, till I unfortunately lost him for want of a foster-mother; also my tame baboon, who used to be almost mad with joy when he saw me, a mere speck on the horizon, returning to the camp from one of my excursions—his sight is infinitely keener than ours.

"From earliest times we have heard tell of an unusually wise bird that our ancestors nicknamed the 'philosopher.' This is the marabou-stork, specimens of which I have come across whose wisdom and fondness for human companionship would scarcely be credited.

"Storks and marabous, which perhaps have lived a man's lifetime or more in the distant velt, have attached themselves to me in the friendliest manner, albeit caught after many difficulties and by strategy. A specimen, well on in years, which I brought with me to Berlin still singles me out from all the other visitors by peculiar marks of affection.

"Of course it means a hard struggle, and it is not easy to win the friendship of such old and peculiarly obstinate birds. For weeks and months one must feed them by force with pieces of meat before they make up their minds to feed themselves. One must tend them oneself, wait on them constantly, and occupy oneself with their needs. Then one day, quite suddenly, all mistrust and fear are overcome, and one is repaid a thousandfold for all one's trouble by making a genuine friend of the bird.

"It must be remembered that I am not speaking of young birds reared by men from infancy, but of birds caught perhaps at the age of thirty or forty years or even older; for marabous attain a very great age, like large ravens or vultures, one of which lived in captivity, under favorable conditions, for a hundred years. My marabous moved about in the camp free and unrestrained. They built their nests, and did not try to fly away. They greeted me on my return with joyful cacklings; they planted themselves close to my tent as sentinels, and caressed me with their powerful and dangerous bills. For a long time my black cook had taken on the duty of feeding them, and their affection for me was not at all the result of my giving them dainties, but of my just and intelligent conception of their habits."

The glories and wonders of the velt are thus vividly portrayed:

"In the Nyika one constantly comes across large white-ant heaps, several feet high and of considerable width. During the night the tiny builders are untiringly active in raising and building their fortresses, which are very strongly put together. At the approach of the rainy season the ants, which by this time are winged, arise from the ground in swarms

to set out on their long wedding journey in the air, to lay the foundations of new colonies elsewhere. Most of them know perfectly how to use their little white pinions, although it is the first and only time in their lives that they rise from the dark depths of the ground in the damp evening atmosphere.

"Here and there the steppes are adorned with the well-known monkey-bread tree (*Adansonia digitate*). Covered with a shining bright gray bark, this tree often attains a circumference of many yards, and, in spite of its grotesqueness, charms us with its primeval appearance. The traveler soon learns to value it, for often rich stores of water lie hidden in the hollow trunk—stores that have been supplied by the rainy season—which may be the only water to be found in the district for several days' journey.

"It appears that the lioness is always the aggressive party. The pictures give only single lions, but in reality there were several others in close proximity. They had gradually surrounded their prey and approached it from different sides.

"There may seem to be something gruesome about sacrificing oxen and donkeys in this way; but they would otherwise fall victims probably to the tsetse fly, a horribly painful death, whereas lions kill very quickly and surely; they just give one bite in the neck, and do not torture their prey. I can vouch for this myself from having witnessed the sight repeatedly from my thorny hiding-place. Death was instantaneous in every case; and so stealthily does the lion creep up to its prey that it is only at the last moment that the latter tries to break away.

"Deep stillness lies over the velt, in the dark night; a gentle rustling is heard now and again in the thick foliage and branches. Suddenly a roaring, mighty something strikes the ear and a heavy thud follows, as the prey is captured. There are never more than a few scratches to be found on the booty; a crunching bite in the neck is always the cause of death. Many men killed in this manner have never even uttered a cry."

An attack from a rhinoceros, Mr Schillings says, is more to be dreaded than that of any other animal. In spite of its huge bulk, it is very agile, nearly always succeeding in ripping its enemy to pieces on its long horn.

"In addition to noting the direction of the wind when stalking a rhinoceros, you have to look carefully to see whether the rhinoceros has his feathered satellites, the rhinoceros-birds (*Buphaga crythrorhyncha*), on him or not. When resting, he often resigns himself to the care of these small feathered friends of his, which not merely free him from parasites, but which, by a sudden outburst of twittering and a clattering of their wings, warn him of impending danger. Thus put on the alert, he rises up quickly and assumes his well-known sitting position, ready to take to flight if need be, but lying down again if there seems to him to be no enemy near.

"If the hunter is favored by the wind and able to conceal himself after this first alarm, and the rhinoceros lies down again, the birds, varying in number from a very few to a couple of dozen, settle down again upon his hospitable body. But the moment they become aware of your near approach they leave it again, arousing the animal once more. It is a case of a partnership between an animal with a very keen sense of smell and birds with very keen eyes.

"Zebras, leopards, and giraffes are so strikingly colored that one would expect to find them conspicuous figures in their own haunts. But, as I have already remarked, these three kinds of animals have really a special protection in their coloring. It harmonizes so perfectly with their surroundings that they are blended in the background, so to speak, and can easily be overlooked. It must be explained that one does not often see the animals close at hand. In certain lights, indeed, according to the position of the sun, zebras, leopards, and giraffes are so merged in the harmony of their surroundings that even when they are quite near, the eye of man can easily be de-

ceived. It is not only in the very dry season, when the plant world stretches out before us in every hue from dirty brown to bright gold, that the giraffe harmonizes with its surroundings in this way; you sometimes cannot distinguish its outline when backed by the green boughs of the trees in the shade.

"The coloring of giraffes varies very much, even in the same herd. I have seen herds of forty-five or more heads, and from close quarters I have ascertained that some were striped quite darkly and some very lightly. All bulls are colored more or less darkly.

"Giraffes dwell chiefly on the plains. About seven-tenths of German East Africa represent an El Dorado for giraffes. Here they find all the conditions of life necessary to them. They can travel a long way from water, as they can do without it for several days at a time. During the rains they get as much water as they want from the moist leaves. Their food consists chiefly of foliage and of the thin branches of the different acacia trees, as well as the leaves and twigs of many other trees.

"When in flight a herd clatters away in straight lines, the whole unwieldy body swings backward and forward, the neck swaying like a mast on a moving sea and the tail swinging to and fro. When outlined against the bare horizon, its appearance is grotesque, not unlike that of a bare tree. Even at a distance, one notes the extraordinarily expressive eyes. I have never heard it utter a sound of any kind; it appears to be absolutely dumb. The fearful blow it can give with its long legs will hold even a lion in check.

"The zebra is a polygamous animal, and the jealousy with which the males watch over their harems often results in bloody encounters. They are very malicious beasts. Indeed lions and tigers are far safer to handle than the zebra, with his fearful bite. They make a peculiar dog-like barking noise when in flight.

"None of the attempts to subjugate them as beasts of burden have met with success—a fact much to be regretted, in view of the rapidity with which horses succumb to the tsetse fly. The problem of transportation in East Africa is therefore far from settled."

Mr Schillings in his introduction gives credit to several English and German sportsmen who had preceded him in hunting wild game with the camera, but he makes no mention of Hon. George Shiras, 3rd, of Pittsburg, who was by many years the first to picture instead of kill the beasts of the forest and plain. The methods and ingenious flashlight apparatus which Mr Shiras invented in the eighties and early nineties have been employed by every camera sportsman since, and were those used by Mr Schillings so successfully in German East Africa. Some of Mr Shiras' photographs were exhibited at the Paris Exposition in 1900, where they were awarded a gold medal, and again at Saint Louis in 1904, where they again received the highest award. About 75 of Mr Shiras' photographs were published in the NATIONAL GEOGRAPHIC MAGAZINE in July, 1906.

SAINT STEPHEN'S FETE IN BUDAPEST

By De Witt Clinton Falls

Member of the National Geographic Society

"FIVE o'clock! Five o'clock!" called the night porter of the Grand Hotel Hungaria, as he knocked on the doors of the different guests' rooms. It roused them from their beds, but not from their slumbers, for that peaceful state had been rudely broken into two hours before by the ringing of every church bell in this twin city of the Danube. It was a beau-

Street Scenes During Saint Stephen's Fete—Budapest

tiful morning, the 20th of August, and the occasion of this early demonstration was to welcome in the day of the greatest of Hungary's annual festivals. In these days of the rapid modernizing of the more traveled countries of Europe, the old-fashioned festivals, religious fêtes, national costumes, and customs are fast disappearing, and there remains no more novel and entertaining sights than those surrounding the ancient fête of Saint Stephen of Hungary.

For who Saint Stephen was and why he was thus honored we must go back some nine hundred and odd years in Hungarian history, from which we gather the following information: Vaik came to the throne of the Magyar Duchy in the year 997. He applied for and received the title of Apostolic King from Pope Sylvester II, and was crowned in Budapest in the year 1000, under the Christian name of Stephen. He did much for his countrymen to bring them into the established church, and founded throughout his kingdom churches, schools, and convents. His administration was a wise one, and so firmly did he deal with the attempted uprising of the "Old Magyar Religion" party that when his death occurred, in 1036, he left his country entirely converted to Christianity. So much had he done for the advancement of the Christian faith among the wild hordes of eastern Europe, and added to the civilization of his subjects, that he was canonized and gladly proclaimed by the Hungarians as their patron saint.

When the Saint passed away, in 1036, one of his hands was amputated and embalmed, and this sacred relic reposes in the court chapel of the Royal Palace in old Buda. Adorned with many handsome rings, it is kept in a crystal casket, set in a beautiful golden reliquary ornamented with many precious stones. In a special shrine behind the high altar, it remains for 364 days in every year, where it can only be seen by the royal household and those having special permission. On the three hundred and sixty-fifth day, the one set apart to do honor to Saint Stephen, it is taken from its resting place, and with great pomp and a most brilliant escort is carried in a procession to the old Matthias Church for a special memorial service. This is the only time that the reliquary is visible to the peasants and the people of the humbler classes, and they come from all over Hungary on that day to do homage to the sacred relic, as it is carried through the streets.

A QUAINT OLD CITY

Budapest has many attractive features that make it in itself one of the very interesting cities of Europe. Here are combined the old and the new world in startling contrast. This twin city is divided by the rapidly flowing Danube, and old Buda, with its ancient fortress, palace, and antiquated buildings, looks across at its most modern sister, Pest. In the old city the streets are narrow and crooked, lined with low and quaint houses. There still clings to it in many places an oriental look, left by the Turks, whose occupation lasted more than two hundred years. In Pest (to which Buda is joined by several handsome bridges) all is different, and in many ways this is one of the most up-to-date of continental cities.

It was in this latter city that the first signs of the approaching festival began on August 19. All during the early morning of that day market wagons had been coming in, laden with supplies of provisions for the expected crowds of visitors, and the market by noon was a study of life and color rarely seen in western Europe. The market building is new and modern in all its appointments. Here you see the farmers and their wives, from the neighboring country, who have driven in with their wagon-loads of produce. This they unloaded in places assigned to them by the police, for everything is conducted with splendid system. The women, to whom the sales seem to be entirely entrusted, vie with each other in making

the best display possible of their wares, and some of the arrangements of vegetables and fruits were exceedingly attractive. This being a market for a holiday crowd, there was a large quantity of the latter, and one was particularly struck by the enormous number of watermelons—there seemed enough to supply all Europe, but none too many, we discovered, for the throngs of merry-makers, who equal our own Southern pickaninnies in their love for this luscious fruit. The farmer's work seems over when the contents of the wagons are unloaded, and he lolls about, smoking his cigarette, or goes for a long glass of native wine in one of the many little cafés. He is rather a picturesque fellow, even in his every-day clothes. He still clings to the national costume, with its flat black hat, wide white trousers (so full that they look almost like a divided skirt), and high-heeled knee boots. Should the day be warm he is sure to remove his short, and sometimes braided, coat, but never lays it aside. He slings it over one shoulder in a manner we are apt to associate with the dashing officers and men of the picturesque hussar regiments. The women wear short skirts of rough material and generally boots similar to the men. Fancy handkerchiefs are sure to be tied over their heads, which makes many bright spots of color among the piles of green vegetables.

OBLIGING POLICE

All day Saturday people came streaming into the city, and by evening the scene was full of gaiety, color, and life. The streets were crowded, and the beautifully lighted cafés were jammed to the doors, and out of doors as well. To accommodate the extra patrons, tables had been placed not only on the sidewalks, but quite across the roadways in some places, the police obligingly closing that portion of the street from traffic. These tables were attractively arranged, lit with little colored lights, and, as the night was warm, seemed more popular than those indoors.

Fancy our famous traffic squad shutting off Thirty-third Street, that the Waldorf-Astoria might accommodate its extra patrons at overflow tables placed outside on the asphalt! But in Budapest this was a people's festival; so busses, cabs, and wagons willingly took another street, that the city's guests might be accommodated and made comfortable and happy. All the hotels were quite full, and many peasants seemed contended to wander about the streets all night, catching a nap where they could, on park bench or doorstep. Their sleep, or in fact the sleep of the entire population, was not to be a late one, for at the first sign of dawn the bells began a great variety of sounds—from the deep boom of those of the cathedral to the sharp tinkle of the small bell of some little chapel. Every church seemed supplied with them, and the ringers seemed to be particularly active on this August morning. If the bells were not enough to arouse one, there were plenty of other sounds; for no sooner had the sun appeared than the streets became full of tramping, talking, shouting crowds; and now and then came the roll of drums or the music of a military band, as detachments of troops marched to the scene of the festival. All were moving in one direction, across the bridges and up the winding, narrow streets of Buda, to the plateau on which the Royal Palace and the Matthias Church are situated.

THE BRIGHT COSTUMES OF THE PEASANTS

The procession was to start at seven, and at least an hour before that time our carriage was at the door and we were off to our position in the Palace Square. The first thing that attracted our attention, as we drove by the walking crowds, was the change of costume of the peasants from the day before. Then all were in their working clothes, but today they are arrayed in all their glory. The men had retained their flat hats, but had generally adorned them with flying ribbons of the national colors—red, white, and green. The white divided-skirt-like

Hungarian Peasant

Hungarian Nobleman

Views of the Procession

trousers were now ornamented on the bottoms of the legs with fringe, or coarse lace, and the dark working coats had been laid aside. In their place were gala ones, always colored—soft browns, reds, and greens—and elaborately braided with different-colored cords. As the day was warm, these were generally worn slung over the shoulders, giving the owners a chance to display their tastes in waistcoats; and in many cases a gaudy taste it was.

The women retained the colored head-handkerchiefs, but they were newer and brighter than those worn on Saturday. Their waists were generally of white or light cotton material, sometimes gaily ornamented with coarse colored embroidery. It was the skirts that were the most unique things about the costumes. Of the brightest colors, they were accordion-plaited, and stood out in the most remarkable manner. How they accomplished this was a mystery to the ladies of our party, until our trusty guide and interpreter had been interviewed. From him it was learned that no Hungarian peasant woman considers herself properly dressed for a gala occasion unless she has on at least twenty petticoats!

Though this made the dress hang out in an attractive manner at the bottom of the skirt, the effect at the waist-line was sometimes startling. We were struck by the beautiful tones of some of the colors worn. This was accounted for by our guide, who told us that these outer skirts (which are only worn on the grandest occasions) were sometimes very old, having been passed down from one generation to another as wedding gifts. The dresses are all quite short, and if the boots of every-day wear had been laid aside, there was sure to be an elaborate display of hosiery. Though some were contended with plain but bright colors, the general taste ran to stripes, and particularly smart seemed those that ran horizontally. The children of both sexes were but miniature counterparts of their parents.

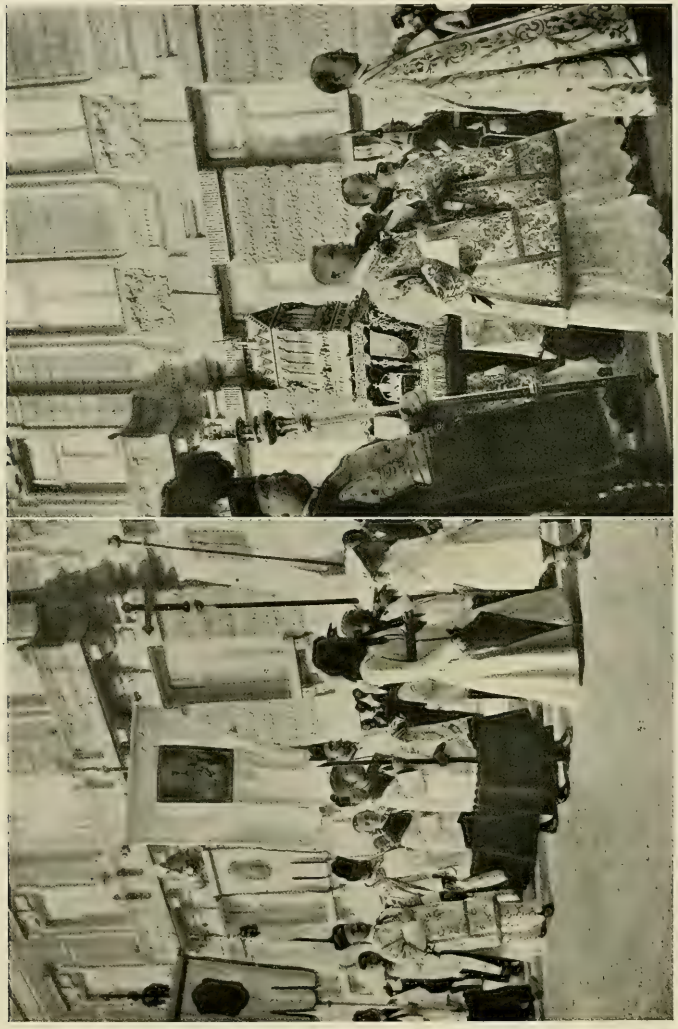
As we entered the streets through which the procession was to pass, we found them lined with troops. They were the men of the Hungarian infantry, their skin-tight trousers laced inside their shoes, and each soldier with three green oak leaves stuck in his shako, in honor of the day.

THE OLD FAMILIES OF HUNGARY HAVE EACH ITS PARTICULAR COSTUME

On arriving at the Palace Square the scene was an animated one. We had been so fortunate as to secure a permit for our carriage to remain there, so that we had a fine point of vantage for our observations. The procession was forming in the inner court of the palace, and through the high, arched gateway a stream of those who were to take part were wending their way. There would be some high church dignitary, humbly walking, arrayed in the beautiful vestments of his clerical rank and attended by acolytes in scarlet and white. Then some nobleman, dressed in the national costume, dashes by in his carriage; for none are of too high rank to do homage to Saint Stephen on this particular day. The costumes of these gentlemen of rank and title were without doubt the most picturesque feature of the whole procession.

The old families of Hungary have each its particular costume, conforming in a general way to the national dress, but with special decorations that make it possible for those familiar with them to tell at once to which family the wearer belongs. The costumes are most elaborate, generally of velvet heavily braided, and ornamented with trimmings of fur, cords of gold and silver, and cut steel or jeweled buttons. With these are worn richly ornamented swords, high boots, heavily spurred, and caps of fur or velvet surmounted by eagle feathers or aigrettes. These are held in place by clasps of curiously wrought gold or silver, sometimes set with precious stones. Let one of these dresses be of red or light green velvet, trimmed with Russian sable, with further addition to the above-mentioned ornaments of numerous orders and decorations, and a Hungarian nobleman of high rank is a picture that it is difficult to equal unless to go to the Eastern home of the gorgeous oriental.

No gentleman of quality in Hungary attends a ceremony of state unless accompanied by a chasseur in the uniform of the retainers of his family. These servants sit on the box with the drivers and are but a trifle less gorgeous than the masters themselves. The general appearance of these costumes were of a military nature, and the style affected that of a hussar cut—tight breeches, short jackets, with an extra coat slung over one shoulder. All were of bright-colored cloth, heavily braided in gold or silver, with an enormous number of buttons in metal to match. Fur hats topped with a single eagle's feather or plume, boots sometimes of red or yellow leather, and a large curved sword completed their outfit; and with their gorgeously arrayed masters they made a brilliant picture, as carriage after carriage drove into the Palace Court.



The Sacred Relic

The Procession

THE PROCESSION

By this time people thronged the square as well as the street leading to it, down which the procession was to pass. It was not a curious, sight-seeing crowd, noisy and pushing, as would have been the case had the coming pageant been of a political or military nature. This was a religious ceremony they were about to witness—one of great solemnity, and to see which some had come many miles. Money had been saved for years for the trip, and possibly it was the one time in their lives that numbers of the peasants were able to make the journey. The police and troops had no difficulty in keeping the roadway clear, the people remaining respectfully behind the lines, many with bowed heads, in prayer or in telling the beads of their rosaries.

At seven promptly the procession emerged from the Palace gateway. It was headed by several hundred children, the girls dressed in white, chanting as they walked along, and carrying many banners on which religious subjects were portrayed. The banners were a feature of the entire procession, as there was a great number of them throughout the line, some very beautiful. Those carried by the children were small and plain, with a picture of a saint on a simple background of some colored material. Later they became more elaborate, and those carried immediately in front of the reliquary were of the most splendid colored brocaded silk, the pictures being magnificent examples of hand embroidery. Behind the children were many religious societies, of both men and women, some wearing special regalias. These also were chanting or repeating prayers in concert, generally led by a priest in full vestments. A battalion of infantry formed the guard of honor and was preceded by a full regimental band. They marched with slow, measured step, the music being of a solemn and churchly nature. Immediately following the military came the priests from the different churches of the two cities, attended by their assistants and acolytes, all in their highest robes and vestments.

The dropping on the knees of many of the spectators and the bowing of heads and crossing of themselves by others announced the approach of the reliquary. Preceded by magnificent banners and by the Archbishop of Budapest, it was borne high in air, so that all might see. It stood on a carved framework, which was elaborately covered with gilding and embroidery, and was carried on the shoulders of four richly robed priests. On each side walked two royal heralds, who represented the King as special guardians of the relic. They were magnificent persons, in crimson velvet, bearing the royal arms of Hungary embroidered in gold on their chests and backs and carrying golden staffs of office richly ornamented. A special guard of honor marched in single file on the outer edge of the immediate escort of the reliquary. This was composed of a detachment of the celebrated Hungarian Palace Guard, the most theatrically dressed troops in all Europe. Their uniforms were a queer combination of past and present. A polished steel helmet of ancient pattern, crowned by a single eagle's feather, surmounted a most modern-cut scarlet uniform, richly braided with silver cord. Their boots were of brilliant yellow leather, and for arms they carried a modern saber, with the long polished steel halberds of centuries ago. The relic was carried past with many signs of reverence and veneration from the spectators and mid a silence that was broken only by the murmurs of lowly spoken prayers.

Immediately behind the reliquary came the nobles and gentlemen, whose costumes I have already endeavored to describe. Individually as they arrived they were unique and showy, but massed together they made a picture of novelty and color to which no camera could do justice. They were followed by many army officers in full uniform and by the

already-described chasseurs, who massed together were but little less brilliant and interesting than the gorgeously arrayed group that had preceded them. Another detachment of infantry brought the splendid cortege to a close.

THE STORY OF THE RAVEN

The procession wended its way through the crowded streets to Matthias Church, where but a small portion of the escort and only those of the highest rank were admitted, as the interior is not large. Around the church was an immense concourse of people, who joined in the service with responses and chanting, as it proceeded inside, priests being stationed at different points to lead them at the proper time. The service lasts some three hours, and while it is going on let us take a look at the outside and into the history of this ancient place of worship. Its foundation stones were laid in the 13th century, and it was started in the Romanesque period. It was not completed until the 15th century, and the style of architecture having then changed to Gothic, it was finished in this school, making rather a queer combination. There are a number of small spires from the period of the original church, all surmounted by large iron ravens, one of which holds an iron ring in his beak. These add a still more peculiar touch to this already odd-looking building. It is to these ravens, or rather to the one with the ring, that the church owes its existence. Way back in the 13th century the consort of King Bela lost a most valuable ring, which she had entrusted to the care of a favorite serving maid. The maid, who could not account for its disappearance, was suspected and convicted of stealing, and, as was the custom of the time, immediately executed. Shortly after her death a raven (one of a flock that made their home about the palace) was discovered playing with a bright object, which proved to be the missing ring that he had purloined through an open window. So great was the grief of the King and Queen at the cruel death of the innocent servant that they vowed to build this church to her memory, surmounting it with the effigy of the real culprit, that all might know of her innocence. During the Turkish domination of Hungary it was used as a mosque. The Turks entirely destroyed the interior, redecorating it to suit their own style of religion; but, strange to say (for it is against the Mohammedan faith to have a representation of a living thing about their places of worship), they did not disturb the famous ravens.

After the service had finished, the procession was again formed in the same order as before, and the reliquary escorted back to its resting place in the Royal Chapel, where it mains until the next 20th of August. The crowd in the streets had waited patiently for another glimpse of the sacred relic, and the same scenes of devotion and veneration were enacted on its return. The religious part of the day being over, the afternoon and evening were devoted to pleasure and merry-making. In the squares and streets near the palace and church, booths had been erected for the sale of merchandise, refreshments, and souvenirs. The latter were all of a religious nature—pictures of saints, sacred medals, shrines, etc., in which the effigy of Saint Stephen always held the place of honor. Later in the day there were music and dancing in different parts of the city, the principal point of gaity being the *Stadtwaldchen,* or public garden, where cafés, shows, and other forms of amusement kept the citizens and visitors entertained until a late hour. Just how late they kept it up we did not wait to see, for with a day begun at daylight, and one with a continual strain on our powers of observation, we were glad to seek the quiet of our hotel.

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THE NATIONAL GEOGRAPHIC MAGAZINE

STRANGE SIGHTS IN FAR-AWAY PAPUA

Seen by A. E. Pratt

Gill Medalist of the Royal Geographic Society

The following article has been abstracted by the Editor from "Two Years Among the Cannibals of New Guinea," by A. E. Pratt, and recently published by J. B. Lippincott Co. Pp. 360. 6 x 9 inches. 54 illustrations and map.

IN the course of thirty years of almost continuous journeying in both hemispheres, it has been my fortune to stray far from the beaten tracks and to know something of the spell and mystery of the earth's solitudes. My work in quest of additions to the great natural history collections, both public and private, of England, and to a less extent of France, has led me to the Rocky Mountains, the Amazon, the Republic of Colombia, the Yangtse gorges, and the snows of Tibet; but it is safe to say that none of these has aroused my interest and curiosity in so great a degree as the scene of my latest and my next expedition, the still almost unexplored Papua, the second largest of the world's islands, and almost the last to guard its secrets from the geographer, the naturalist, and the anthropologist.

Fifty years ago schoolboys, looking at their map of Africa, blessed the Dark Continent for an easy place to learn. A few names fringed the coast; inland nearly all was comprehended under the cheerful word "unexplored." Such in great measure is the case with New Guinea today. Its 300,000 square miles of territory, held by Great Britain, Germany, and the Netherlands, and now lying fallow, are destined in the course of the next half century to enrich the worlds of commerce and of science to a degree that may to some extent be forecasted by what is already known of very restricted areas.

Be this as it may, one thing remains sure, the extraordinary value of Papua to the man of science, particularly to the entomologist and the ornithologist. In the department of ornithology alone we already know of 770 different species of birds inhabiting the mainland and the islands, which places it in this respect far above Australia, which, with a superficial area nine times greater, possesses less than 500 species in all.

The ethnologist, too, has in Papua a happy hunting ground, for the tribes on the fringe of exploration present wonderful varieties of type, and as the mountain fastnesses of the interior are gradually opened up, there can be no doubt that rich material for the propounding of new problems and perhaps the solution of old

ones will come to light. Language is curiously diversified; here you meet a tribe with a distinct speech, and camping near them for a time you learn the common currency of their tongue; a few miles further on appears another people, perhaps not greatly differing in type, but with another language altogether.

THE FIERCE TUGERI OF DUTCH NEW GUINEA

I went first to Merauke, in Dutch New Guinea, to explore and collect in new territory, but the long-standing difficulty with the warlike Tugeri tribe was still acute, and the very day after I landed we had abundant proof of how unwise it would be to penetrate into the interior. On that day three or four Javanese convicts, who were working on the edge of the clearing, were heard to shout as though in distress. In five minutes an armed guard was on the spot, but all the convicts were found decapitated by the head-hunting Tugeri. The heads had been taken off with the bamboo knife so cleverly that the doctor on board our ship told me that no surgeon with the latest surgical instruments could have removed so many heads in so short a time. This bamboo knife of the Tugeri is a very remarkable weapon. It is simply a piece of cane stripped off from the parent stem, leaving a natural edge as keen as the finest tempered steel.

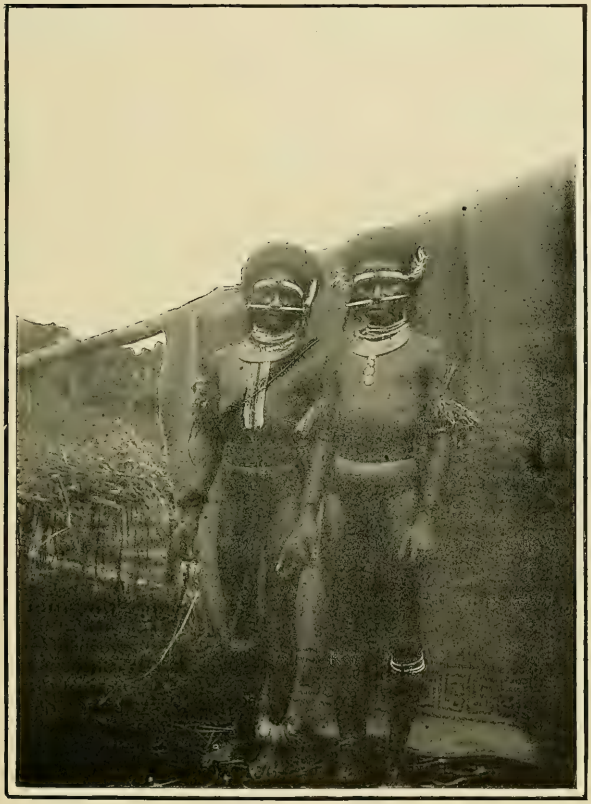
My opportunities for observing the Tugeri were therefore necessarily limited, but I am, I believe, the first person who has made any study of this remarkable tribe, and as far as I am aware they have remained hitherto undescribed. They are a very numerous people, inhabiting a tract of country extending as far west as the Marianne Strait and as far east as the Fly River, at longitude 141°.

The Tugeri are a fine race, very fierce, and absolutely unspoiled by European vices. The men stand about 5 feet 8 inches on an average, and are clean-limbed, powerful fellows, capable of any amount of endurance. As a race, they are broad-shouldered, sinewy, and of enormous strength. No European can draw their bow. This weapon is made of a longitudinal section of the bamboo. Near the grip the diameter is about 3½ inches, and the wood tapers at each end to a diameter of ¾ inch. The string is of twisted fiber, and the arrow, which is made of a reed, carries to a distance of at least 300 yards. Like all savages, they are admirable marksmen.

CURIOUS ORNAMENTS OF THE TUGERI

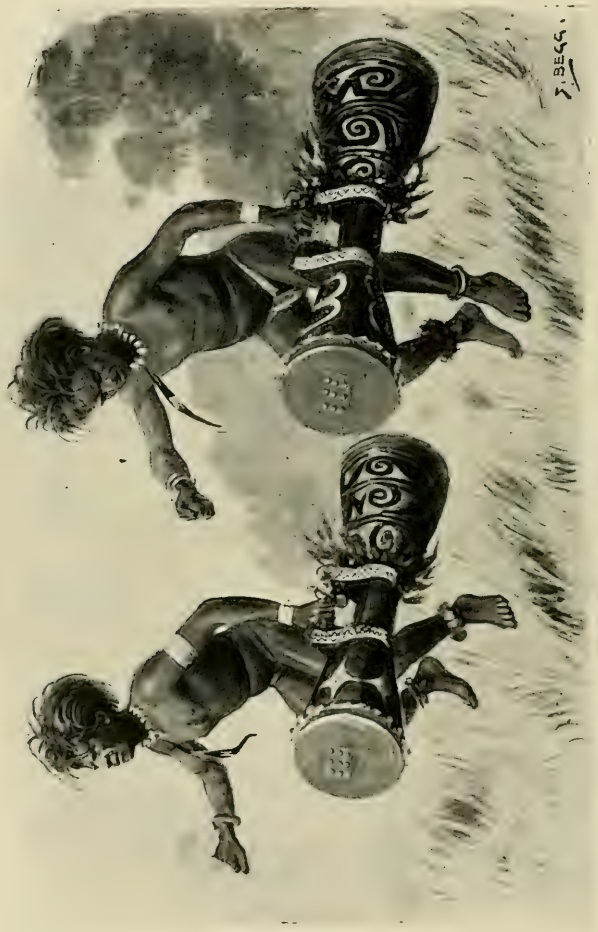
The men wear an enormous ear ornament of bamboo bent into an open ring. Round the periphery of this ring the flesh of the lobe of the ear, previously perforated, is stretched in infancy, and as the individual grows the natural spring of the bamboo stretches the flesh more and more, until in manhood a loop is formed big enough to hold a ring of at least 4 inches in diameter. It is extraordinary how the tribesmen contrive to move amidst the tangled forest without hindrance from this abnormal expansion of the lobe, the most unusual flesh decoration to be found among mankind. When the bamboo is out the loop hangs like a long pendant, a perfect skein of flesh, a peculiarly hideous accessory of savage adornment. Some of the Tugeri wear an apology for a beard, or, rather, two scraggy tufts of hair depending from each side of the chin. The use of pomatum in any form is unknown. The teeth are strong and fairly regular, but perfectly brown, owing to the habit of chewing the betel-nut.

For personal adornment the Tugeri wear two crossed straps of dogs' teeth strung together with grass. Each strap is about 3 inches wide, and is formed of nine parallel rows of teeth. The strap that rests on the left shoulder passes under the right armpit; that over the right shoulder passes outside the left arm above the elbow. The straps are lightly fastened at the point where they cross the breast. Round the right arm, just above the elbow, they wear a curious armlet. In the case of the richer tribesmen, this is of shell. The breadth is



Two New Guinea Dandies

Notice their tight-laced waists and the nose ornaments (chimani) of polished shell. (See page 569.) This series of photographs are from "Two Years among New Guinea Cannibals," by A. E. Pratt. J. B. Lippincott Co., publishers.



Curious Drums of the Tugeri (Dutch New Guinea)

The body of the drum is cut and hollowed from a solid trunk and curiously carved. The drumheads are of lizard skin

from 5 to 6 inches. On the stomach, to the right, are two or three horizontal scars, made by cutting or burning. These are self-inflicted for superstitious reasons. The lower part of the stomach is tightly drawn in (often extremely tight) with a coil of finely plaited fiber. This seems to be worn for elegance alone, and tight-lacing is a ruling fashion among the Tugeri dandies; the tighter the lacing the greater the dandy. From fifteen to sixteen years of age the young men are hopeless victims to fashion. The Tugeri go barefoot, but wear grass anklets adorned with shells, which rattle like castanets, as they walk. I observed, however, no dances, although these, I understand, are performed in their villages. For decency's sake they wear a shell, after the manner of the statuesque fig-leaf, and their costume is completed by a necklace of dog's teeth and small pieces of bone, such treasures as a savage prizes.

A strange part of the Tugeri's paraphernalia was their extraordinary drums. The body of these, shaped like a dice-box, was hewn out of a solid log, hollowed, and curiously carved. Midway at the narrowest point was a clumsy handle, also hewn from the log. The drum-heads are of lizard skin. The performer carries the instrument by the handle in the left hand and beats with his right. The noise is prodigious.

A UNIQUE TRADING VILLAGE

Leaving Dutch New Guinea, I proceeded down the coast to Port Moresby, the seat of the British government of New Guinea. From here I planned to penetrate about 200 miles into the interior and make a permanent camp among the hills, in order to carry out the object of my expedition—the collection of butterflies and moths. But before leaving the coast I had an opportunity of seeing something of a very interesting village, Hanuabada, a sort of miniature Venice, where all the houses are built on piles over the water. The people of this village annually send out a trading expedition to a distance of several hundred miles to dispose of the pottery manufactured by them.

For weeks before the annual trading expedition Hanuabada is full of life. At every turn one comes upon women crouching on the ground, fashioning lumps of clay into wonderfully perfect pottery, for which the village is famous. The men folk, although they do not condescend to take part in the actual fashioning of the pots, are good enough to dig the clay, which they take out of the ground with a stone adze, a flat stone blade lashed to the shorter extremity of a forked stick, the longer extremity forming the handle.

There is a distinct organization of labor among the potters, the women being divided into "makers" and "bakers." Several "makers" work together in a group. They use no wheel, but seize a lump of clay with both hands and make a hole large enough to get the right hand in, whereupon they gradually give the vessel its contour. After being roughly shaped, it is smoothed off with flat sticks or the palm of the hand. The finished article of Hanuabada ware is in the form of a flattened sphere with a very wide mouth and a neatly finished rim six or eight inches across. Farther to the east, along the coast, the pottery is highly decorated, but it is much more crude in form and has no fine rim. The pots are dried in the sun for several days, and then they are turned over to the "bakers," whose fires are blazing in every street. There are two methods of baking: one is to lay the pot on a heap of hot ashes; the other to build the fire right around it. The vessel is watched through the whole process, and is continually turned on the fire with a little stick thrust into the mouth.

When many hundreds of pots have been completed the Hanuabada people begin to think about the disposal of their wares. Their great market is at Paruru, a long way up the coast. They barter their pottery for sago with the nations of that district, and it is very curious to note that this extensive trading organization on the part of an utterly savage

people has been in existence from time immemorial and is no imitation of European methods. To reach Paruru the potters must undertake a perilous voyage, for which they are dependent on the tail of the southeast monsoon. The captains, of course, have no knowledge whatever of the science of navigation and sail their vessel by cross-bearings, or, when out of sight of land, by sheer instinct. The vessel is constructed of a number of canoes lashed together, and is propelled by two batlike sails.

Another interesting feature of this region was the presence there of a piebald people. For the most part their bodies were brown, but they were marked with pinkish patches, unevenly distributed. It is not improbable that this marking might be due to a disease contracted from a too constant fish diet, but if it were a disease I could not discover that it gave any discomfort. Against this theory must be set this fact, that I observed one man in whom the light markings predominated. In fact, he was quite fresh-colored, like a European, and had light hair. These piebald people were not a class apart from the rest of the Hula villagers, but shared their life in every respect.

PENETRATING INTO THE FOREST

At times the brushwood was very dense and we had to cut our way, but where the forest was closely matted above, forming a thick canopy, which excluded the light, nothing, of course, could grow beneath. At points where the light penetrated the undergrowth was immediately thick again. The path, such as it was, was stony and hard. As we trudged along in the wet we made the acquaintance of a new discomfort. This manifested itself in the presence of a leech, a little creature about ¾ inch long, with slender body, very much smaller than the European variety, but inflicting the same sort of three-cornered bite. The native carriers offer the easiest victims, for the leeches fasten upon their bare heels in great numbers, and they had constantly to stop and brush them off with little switches which they carried in their hands. Sometimes, when the leeches had bitten very deep, the carriers had to lay down their loads and pull them off with their fingers. They would endure them until they became too bad, say when a dozen or so had adhered to each foot. At this time we did not suffer much, but later on, in the journey from Faula to Mafulu, they got over the tops of our boots and socks and attacked our ankles. The bite was not actually painful, and the presence of our enemy was not revealed until we realized that our feet were wet with blood. The chief haunts of the leech are wet stones and moss and low herbage.

EDIBLE PALM AND EXTRAORDINARY ORCHIDS

About the elevation that we were traversing there grows a particular kind of palm, peculiarly grateful to the native when he is hungry, a not infrequent occurrence, and at such moments of stress they discard their loads, search out this palm, and cut it down. At the top, just below the crown of the palm, the last shoot, about six feet long, remains green. It is opened lengthways and is peeled until the inside layers are reached. These layers are straw-colored, like asparagus, and to the taste are sweet, slightly dashed with acid. Europeans, as well as natives, can eat great quantities of this wholesome and enjoyable food with impunity. It is excellent also for quenching thirst, for which it is often most convenient, as it grows in waterless regions.

The gloom of the forest was diversified by the colors of its extraordinary orchids. One of these (*Grammatophyllum speciosum*), which had made its home on a lofty tree, was of almost incredible luxuriance, and could the whole plant have been secured it would not have weighed less than half a ton. I despatched one of my native boys to climb the tree to see if he could secure a specimen. He went about his task in the native fashion. The climber stands with his face to the trunk, which, as well as his body, is encircled with a hoop, and his ankles are tied together.

A Piebald Tribe: The Motu-Motu People of Hood's Bay and a Typical Kalo House

The piebald people are one of the mysteries of New Guinea, and their origin is unexplained. The spear in the warrior's hand is made of hard redwood, sharpened, and has no metal. The house is built on an open wooden framework, and the flooring of the dwelling-room begins at the bottom of the closed-in gable. On this inflammable floor, within the thatch of flag grass, they actually have a fire on a mud hearth. The slanting pole is a ladder for the inhabitants. In some cases they have little ladders for the dogs.

First he leans back until his body has purchase on the hoop, and then, at that moment, by the leverage of his ankles, he makes an upward movement of about a foot. Then, falling backward against the hoop and pressing his feet against the trunk, he is supported for the next spring. This operation is repeated with marvelous dexterity and rapidity, and with this contrivance the youth makes his way to the top. There is no tree in New Guinea that a native cannot climb thus.

Under a large tree that rose to a height of some 150 feet were huge mounds, quite five feet high, of veritable sawdust, that seemed to proclaim the presence of man. On a nearer approach the wonder became greater, for the heaps were being continually augmented by a constant rain of sawdust of different grains, some finer than others. No human sawyer, of course, was there, but the tree, to a height of at least 100 feet, was riddled by coleopterous larvæ. Several families of these were represented. The tree, which was about five feet in diameter and had a thin bark, was, as might be expected, dying. It must have possessed some strange attraction, for it was most unusual in New Guinea to find beetles thus congregated. The distribution is usually very scattered. The holes were probably made at first by small beetles of various families, but chiefly Anobiadæ, followed as a rule by Brenthidæ, later probably by Longicorniæ. One species follows the other into the same hole, each succeeding species bigger than its predecessor. Sometimes the lepidoptera make borings, but this sawdust was much finer. Only a few living branches remained on the tree, which was a mere shell. It was, however, so well protected from winds that it still stood.

STINGING TREES AND STINGING PLANTS

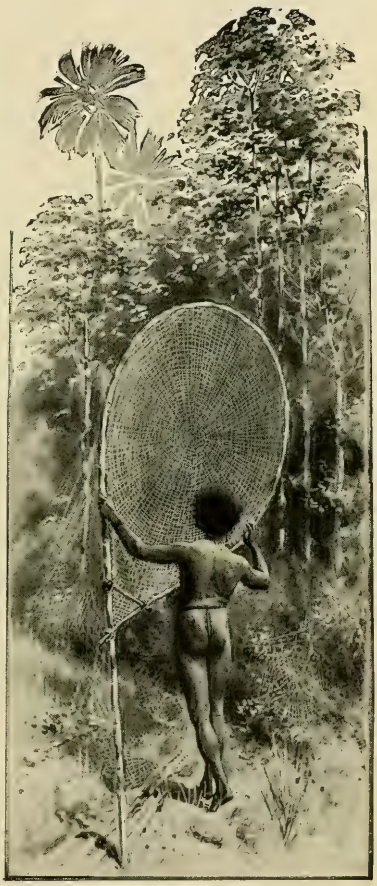
The difficulties of our march were heightened by certain natural features, particularly by the stinging-trees, which occurred close to Madui. The tree in shape, size, and foliage resembles a sycamore, and has a leaf of which the under side is extremely rough and covered with spines. These possess a stinging power like that of the nettle, only much worse, and the irritation lasts far longer. The slightest touch is sufficient to wound. First a white blister appears, then redness, covering about a square inch around each pustule; rubbing aggravates the irritation, which shortly becomes maddening. The pain is not allayed for at least twelve hours, and I have never observed any natural antidote growing in the vicinity of this stinging-tree, as the dock-leaf grows near the nettle. Needless to say, the natives take the utmost care to give these trees a wide berth.

A smaller stinging-plant, resembling our nettle, only larger, with a rough under side of pale pea-green, is also found at *intervals* in the forest; both sides of the leaf possess the power of irritation. The natives use it as a universal specific for all ailments. As soon as they come on a clump of this plant the women discard their loads and gather bundles of the leaves, which they carefully preserve for future requirements. It is also applied, probably for the sheer pleasure of it, when they have no actual disorder, and it is quite common for them to rub their bodies lightly with the leaves. This causes violent irritation, followed by a feeling of pleasant numbness, like that which results from the application of menthol. For a mosquito bite this is a most admirable remedy, since the irritation of the bite is allayed and goes down long before the irritation of the leaf has passed. It is a curious example of the old medical practice of counter-irritation. Although we were glad to resort to it for mosquito bites, no European would, without that cause, risk the irritation for the sake of possible future benefits.

THE SPIDER'S FISHING NET

One of the greatest curiosities that I noted during my stay in New Guinea was the spiders' web fishing-net near Waley. In the forest at this point huge spiders' webs, 6 feet in diameter, abounded. These are woven in a large mesh, varying from 1 inch square at the

outside of the web to about ⅛ inch at the center. The web was most substantial, and had great resisting power, a fact of which the natives were not slow to avail themselves, for they have pressed into the service of man this spider, which is about the size of a small hazel-nut, with hairy, dark-brown legs spreading to about 2 inches. This diligent creature they have beguiled into weaving their fishing nets. At the place where the webs are thickest they set up long bamboos, bent over into a loop at the end. In a very short time the spider weaves a web on this most convenient frame, and the Papuan has his fishing net ready to his hand. He goes down to the stream and uses it with great dexterity to catch fish of about one pound weight, neither the water nor the fish sufficing to break the mesh. The usual practice is to stand on a rock in a backwater where there is an eddy. There they watch for a fish, and then dexterously dip it up and throw it onto the bank. Several men would set up bamboos, so to have nets ready all together, and would then arrange little fishing parties. It seemed to me that the substance of the web resisted water as readily as a duck's back.



A Spider's Web as a Fishing-net: A Strange New Guinea Device

A very huge and strong spider's web, common to New Guinea, is used by the natives as a fishing-net. They set up in the forest a bamboo, bent as in the picture, and leave it until the spiders have covered it with a web in the manner shown.

AN ARMY OF SOLDIER-CRABS

On one of our expeditions along the coast we saw one of the most extraordinary sights of all our travels—many thousands of soldier-crabs traversing the sandy beach in detached, regularly ordered bodies, that moved evidently by the signal of some common commander. These "armed battalions" stretched for miles, and no matter what figure they assumed, whether wedge, triangle, or rhombus, the dressing, so to speak, of the outer ranks was perfect, and would have put many a volunteer corps to shame. Not a crab was out of line. The advance was fairly rapid, and was always toward the sea for a distance of, say, two hundred yards. When the crabs come out of their holes in the sand they throw themselves into this compact for-

Fishing with the Spider's-web Net

The natives are here using the curious net prepared in the manner shown on page 567

mation probably for safety. There was no walking along the beach for them, there being scarcely a clear hundred yards for miles. When approached they quickened their pace perceptibly.

The individual crab is small and has no shell. The spread of the legs would probably be 1½ inches, and the body is of dark fawn-color, exactly resembling the wet sand of the beach, so that the creature's hue is without doubt yet another of Nature's adaptations for protection. It is remarkable also that it imitates only the wet sand, for the dry sand is of a dazzling silky whiteness.

Equally wonderful is the bower-bird, at once gardener, architect, and artist. Not only does it build the most extraordinary nest known to naturalists—a long, tunnel-like bower, framed like a delicate Gothic arch—but it actually lays out a garden. I have myself seen the creature's marvelous achievement. It has definite color-sense, for it picks the blossoms of orchids and arranges them in alternate lines of mauve and white. The whole impulse is, of course, the universal one of love, for among its rows of flowers it dances to its mate. This was probably the prettiest and most fascinating of all the sights provided by Nature in New Guinea, that land of surprises.

REMARKABLE NOSE ORNAMENTS AND HEAD DRESS

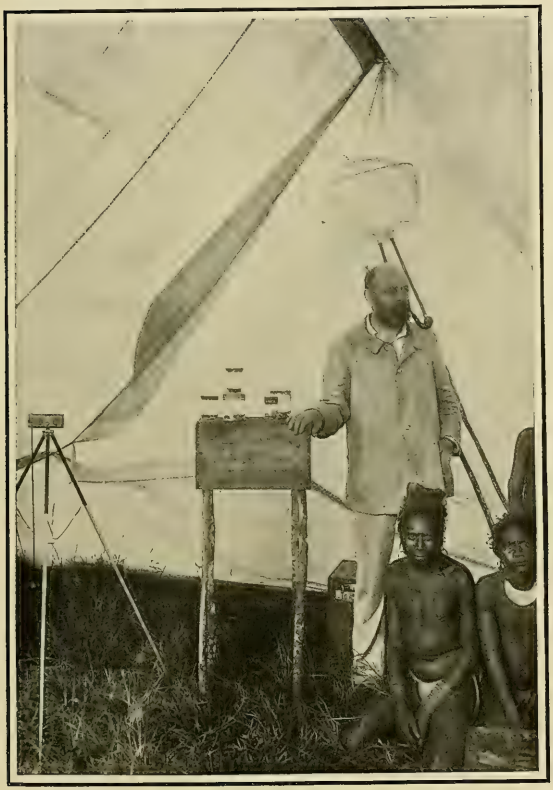
The chief costume of the women of the coast tribes is the extraordinary petticoat made of grass or of a wide-bladed weed, each leaf of which would be about 3 inches wide. The blades composing this garment fall down perpendicularly from a waist-band, to which layer after layer is attached, until the "rami" has that fine spread which used to be attained by more civilized women by a contrivance which was called a "dress-improver." As we went inland and rose gradually higher and higher in the mountains, we observed that the "rami" was growing shorter and shorter, until at length it disappeared altogether, and one may reasonably consider the absence or presence of this garment as the great symbol of division between the coast natives and those of the highlands proper.

Among the men, both highland and lowland, the great symbol of dandyism is the "chimani," or nose ornament. This is made from a section of a shell about ⅜ of an inch thick in the middle and tapering most beautifully toward the ends. It is accurately made, perfectly round and polished, and a good example would be about a span long. A fine "chimani" very often has two black rings painted round it about one inch distant from the end. These things are manufactured by the coast people, and they drift by exchange through the whole country. Very few young blades can afford to possess one, and accordingly it may be lent, either for a consideration or as a very special favor. The possessor of one of these ornaments could easily buy a wife for it, and sometimes it is paid as a tribal tribute by one who may have to pay blood-money, or is unable to give the statutory pig as atonement for a murder.

But the most splendid of all the articles of the Papuan costume is the feather head-dress, 16 feet high, which forms the central point of attraction when it occurs in a tribal dance. This ornament is extremely rare and is always an heirloom, for it has taken generations to complete. It is a wonderfully fantastic device of feathers, built upon a light framework. The Bird of Paradise and the Gaura pigeon are laid under tribute for its construction, and the feathers of the different birds and of different species of the same bird are kept carefully apart and are arranged in rows according to their natural order. A few lines of Bird of Paradise, a few lines of Gaura pigeon, then a few lines of another species of Bird of Paradise, and so on. The whole contrivance is most fantastic, and looks really impressive in the weird light of the torches, as the dancers, decorated with flowing bunches of grass behind, proceed with their revel.

Although the women do all the hard

New Guinea Women Wearing the Rami, or Petticoat Made of Leaves



Mr A. E. Pratt and Some Native Collectors

work of the house and in the field, they are nevertheless regarded with affection. It is erroneous to suppose that they are compelled to be burden-bearers because they are lightly esteemed. As far as my own observation goes, the men are left free of loads, or are given lighter loads, in order that they may be ready to protect the women from the sudden raids of other tribes. Their gardens are often a considerable distance from the village, and the women never go to gather yams or taro or to till their patches without an escort of young men as protectors.

On the other hand, the men are not idle, but perform their part in the economic system by acting as hunters. Their chief game is the pig, the cassowary, and the wallaby. They hunt this quarry with spears, and drive the game into nets which have been spread between the trees and posts in the forest over considerable

area, forming a corral, approached by a long decoy, two long lines of nets gradually converging. When the nets have been set the drive commences. The beaters extend themselves for considerable distance, and with the assistance of dogs gradually force the game toward the corral; birds and beasts are forced into the center in crowds. At length the hunters close round the opening, a final rush is made, and the victims are despatched with spears. These hunting bouts occur only at long intervals and on the lower slopes of the mountains. After a successful drive, there is a great jollification. Fires are built in the camp, the game is roasted, and in an incredibly short space of time every portion disappears and the people are lying around gorged.

CURIOUS METHODS OF BLEEDING

A curious form of bleeding is in use among the tribes, especially among the younger men. The bleeding is performed by two persons, who sit opposite to each other. The operator takes a small drill, or, rather, probe, of cassowary bone brought to an extremely fine point, and this is attached to the string of a tiny bow, about four inches long. Holding the bow as if he were going to shoot, the operator aims the little probe at the patient's forehead, draws the bow slowly, and lets the string go; the probe is thus brought into sharp contact with the patient's skin, and the operation of drawing the bow and letting fly the arrow is repeated again and again until blood is drawn. It should be remembered that the probe or arrow is always attached to the string and never escapes. The patient now leans forward and the blood is allowed to flow profusely onto the ground.

I have often seen as much as half a pint allowed to escape. When faintness supervenes the wound is staunched with ashes or any convenient styptic and the patient sits up. If the ashes fail to act, cautery with a hot cinder is practiced. Headache is the usual trouble for which this remedy is applied, and this frequency of bleeding may be the reason why there is no heart disease or sudden death among the natives. This may probably lend color to the theory of some physicians that the increase of heart disease and sudden death in civilized nations is due to the entire abandonment of bleeding, once certainly carried to excess.

During our journeyings in the interior we depended on native help alone, and the people we employed were not, one might say, scared out of their usual way of life by the presence of a large body of white men. I and my son went absolutely alone into the wilds, with no white lieutenant. We cast ourselves, as it were, on the hospitality of the aboriginal Papuan (and cannibal at that), but we had no reason to regret our draft on the bank of savage fidelity.

BOLIVIA—A COUNTRY WITHOUT A DEBT

By Senor Y. Calderon

Minister from Bolivia to the United States

I HAVE been honored by the National Geographic Society in being asked to make an address, under its auspices, on the subject of Bolivia, my country. I accepted the invitation with pleasure, coming, as it did, at the time when the recent historic visit of the Secretary of State, Mr Root, to South America has awakened special interest toward the republics situated south of the Isthmus of Panama.

It may be said that the foresightedness and wisdom of this great statesman has torn the veil that obscured the vision of those republics and revealed to this country the young nations striving for progress and peaceful development.

I was fortunate in hearing the addresses of the honorable Secretary of State, delivered in Kansas City* and in Cincinnati, and I earnestly recommend to all of those who are interested in the prosperity of the sister republics, and in fostering our mutual relations, to study them with careful attention.

You are aware of the spontaneous ovations with which Mr Root was received by the countries where he touched on his voyage. From the first moment, he gained the esteem and the confidence of the southern republics. With feeling and eloquent words he interpreted the sentiments of this great nation and the message of peace, of fraternity, and of respect for their sovereignty was proclaimed to the world by one of the highest officials as well as one of the most eminent citizens of this country.

The reception of Mr Root in South America, besides being a personal tribute offered to his merits, was the sincerest expression of good will with which they accepted the proffer of friendship sent by the government and the people of North America.

In his last message sent to Congress, the great American who so brilliantly guides the destiny of this Republic has confirmed in clear and forcible words the friendly declarations of the Secretary of State, thus giving them governmental sanction and dispelling the mistrust created under the wrong impression that the United States had designs on establishing its supremacy and dominion over all the continent. The words of President Roosevelt reveal the high spirit of justice that guides his policy, and mean the application of the "square deal" to international relations.

If the progress and stability that prevail in the South American republics had not been known by Mr Root and he had gone on his visit expecting to see some of the insurrections which are supposed to be occurring constantly, he would have been greatly disappointed. In place of military chiefs arrayed against each other, of cities given over to disorder and war, he would have found, as he did find, peoples filled with life and anxious to put themselves on a level with the most advanced of the globe.

OUR PAST DID NOT TRAIN US FOR THE EXERCISE OF LIBERTY

We have inherited from our ancestors traditions little suited for the exercise of liberty and the respect for human personality. Our education was not like that of the English colonies in North America; the political life of the Spanish colonies was controlled by the delegates of the crown, and the people had nothing to do but to blindly obey.

In honor of the good intentions of the

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mother country, it may be said that the Spanish laws contained numerous and very paternal dispositions in favor of the distant American dominions and of the aborigines whose fate is and has been so cruel.

In practice it was another thing; the Hispano-Americans were excluded from all the most important posts and lived in a depressive condition as compared with that of the men from the Spanish peninsula. In regard to the great mass of aborigines, their position was much sadder than that of slaves. Condemned and forced to work in the mines by drafts, called *mitas;* excluded from the benefits of instruction and deprived of all their rights, they acquired the vices of the conquerors and lost the virtues of their ancestors.

In order that we may form an idea of the despotism to which the descendants of the Inca Empire were subjected, it may be mentioned that they, a race of beardless men, were compelled to buy shaving razors, and for an Indian to appear on horseback was considered a misdemeanor punishable by whipping.

The Spanish possessions in America were closed to all contact with the world and isolated from intercourse and exchange of ideas with the peoples of Europe. The fundamental principle of government was to exact absolute obedience to the king and his representatives, and in religious matters, under the withering hand of the Inquisition, freedom of conscience was condemned.

Such conditions were not the best preparation for beginning the life of independent republics and to proceed without stumbling.

The people of the United States of North America not only imbibed from their English ancestors the love of order and habits of liberty, but had a vast territory free from obstacles, fruitful and watered by great rivers, and placed opposite Europe, from whence came a constant current of immigration that has greatly contributed to its advancement.

The Latin republics of South America, although occupying a territory more than double the size of the United States, encounter the great barrier of the Andes through the continent, from north to south, preventing the communication of the peoples.

The distance separating them from Europe is almost twice as great and much more difficult to travel. The immigrant arrives in this country in a few days and at a small expense, while the voyage to South America is so long and so costly as to prevent him from going there.

In order to correctly judge the conditions and the development of the English colonies after their emancipation, as compared with the progress made by the Spanish colonies, it is well not to forget these circumstances.

The Spanish conquerors have left behind them a legend unrivaled in the world's annals for audacity and perseverance. If they had displayed less cruelty toward the vanquished and greater respect for human rights and less thirst for gold, the pages of their history would be the most brilliant of mankind.

We, their descendants, if we inherit many of their defects, have also the noble qualities that make the Spanish people the most chivalrous of Europe, with a history filled with great examples of patriotism and heroic achievement.

THE VAST INCA EMPIRE WHICH FLOURISHED FOR 500 YEARS AND IN WHICH PROPERTY IN LAND DID NOT EXIST

Before I begin to speak of the actual conditions in Bolivia, permit me to draw a sketch of the historic antecedents preceding the organization of the Republic.

Situated at an altitude of 12,500 feet above the level of the sea and secluded between two great branches of the Andes, lies the mysterious Lake Titicaca, whose waters form the boundary between Peru and Bolivia. There, on the Bolivian side, is found, among others, the Island of the Sun, from whence pro-

ceeded, according to tradition, Manco Capac, his wife and sister, Mama Ocllo, founders of the Inca Empire. They claimed to be direct descendants of the sun and came to the world to civilize it and to establish the reign of peace and good will. Manco Capac taught the men to cultivate the soil, while his wife instructed the women in the art of spinning and weaving. And thus, under a theocratic and paternal government was developed a vast empire—the grandest experiment of an organized communism recorded by history.

Gareilazo de la Vega, in a work entitled "Royal Commentaries," has left us an attractive and simple picture of this admirable social organization, in which the individual disappears in order to become a mere factor in the general well-being. Property in land did not exist; the fields were allotted periodically and the harvests were divided into three parts, destined to the Inca, to the maintenance of worship, and to the public in general. The paternalism of the Incas went as far as to exercise a permanent vigilance over the private life, as their subjects were not permitted to have their doors closed; so that all their acts might be subject to inspection by the authorities.

The Inca Empire, during the five centuries of its existence, extended in the north to the present confines of the Republic of Colombia, and south as far as Chile and the northern part of Argentina, embracing a great portion of the Pacific coast, and all of the territory of the present republics of Ecuador, Peru, Bolivia, and northern Chile. Attesting the advanced degree of its civilization are the monuments remaining on the Island of the Sun and those of Cozco, as well as the ruins of the magnificent system of roads throughout the Inca's dominion.

However, in spite of the ten or twenty millions of inhabitants, it fell as a statue of clay before a few score of adventurous Spaniards, who in a few years made themselves masters of the country and submitted the inhabitants to servitude, almost without resistance. Educated in the religious respect of the sacred power of the descendants of the Sun, they had lost the strength and manhood of nations invigorated by individual freedom.

The power under whose shadow they had lived being broken and destroyed and being suddenly left to themselves, the subjects of the Incas fell easily under the dominion of the conquerors, whose arrival confirmed the popular tradition that some day men with beards would come from over the seas and take their homes.

CITIES OF GOLD AND SILVER

Once possessed of the country, the Spanish extended rapidly their search for gold and silver throughout the territory. In 1548 Alonzo de Mendoza founded La Paz, today one of the principal cities of Bolivia, attracted thither by the rich gold ore of the rivers of that section. In fact, the mines of Chiquiaguillo, just outside the city, have produced great quantities of gold and nuggets of considerable value. In 1718 the Marquis de Castel Fuerte sent to Madrid a nugget weighing 760 ounces of gold, and recently the German company that works these mines sold, among other nuggets, one encrusted in quartz weighing 52½ ounces, of which 47 ounces were gold. It may be affirmed that all of the rivers in the vicinity of La Paz flowing from the Cordilleras carry gold.

The city of Potosi was founded in 1545, and fifty years later it had reached a population of 160,000 because of the enormous richness of the mountain at whose foothills stand the city. The quantity of silver produced by the mines of Potosi for more than three centuries is fabulous and has made its name a synonym of wealth. The city became a goal for all classes of adventurers, bankrupt Spanish nobles, merchants anxious to make fortunes, and all kinds of men contributed to make Potosi a center of prodigality, of romantic adventure and disorder.

The chronicles of Potosi are interesting as well as instructive. We see depicted the customs of those ages, with all their preoccupations and fanaticism as well as the spirit of chivalry and love of adventure. Spanish hidalgoes prided themselves on squandering great fortunes in feasts and revelry, which often caused strife among the bands in which the city was often divided.

ANECDOTES OF THE MINERS

The anecdotes of those times that have reached us are really curious and amusing, and as samples I will relate some of them: A miner named Quiroz was one of the most fortunate of his day—a man of generous spirit, who by his liberality won the affection of his fellow-men. It is related that he caused to be made a series of drawers in an immense wardrobe in his home, and in each drawer he would put a sum of money, varying from one to thousands of dollars. Then, as today, there was no lack of men anxious to secure a living without work, and when any one presented himself to ask for help he was ordered to open one of the drawers and try his luck. The prodigality of this man became a proverb; it was said, "After God, Quiros" (Despues de Dios, Quiroz).

On a certain feast day the butlers of two great houses met in the public market, and both wished to purchase a certain delicacy, very rare in such a place as Potosi. The competition was started between the two, who tried to outbid each other. One of the butlers, believing that the price had gone too high, and that he had done enough to uphold the name of his master, left the other with the coveted prize, and when he reached home and related what had occurred he was promptly discharged for not having sustained the honor of the house and allowed the other fellow to get the best of him.

One of the characteristics of those times was the religious fanaticism; and the miners, in order to insure their salvation or pardon for their sins, donated enormous sums of money for the building of churches and convents, and this explains why so many churches are found today in the old Spanish towns.

The Carnegies of those days did not possess the broad and high mind of our own Carnegie, who has once more shown his noble ambition by his recent magnificent gift of $750,000 toward the building of the palace for the use of the Bureau of the American Republics, which will be a lasting monument to their friendship and the cosmopolitan sentiments of its promoters.

If in political and administrative affairs the sovereign will of the king and his representatives was the law, so in domestic life the father, as chief of the family, was equally the supreme ruler, the wife and children being his subjects. It may surprise the young ladies to hear that in many cases the contracting parties, whose marriages were always arranged by the respective fathers, did not know each other until the time of the ceremony which was to link them together for life as man and wife.

For fear that the girls would employ their time in writing love letters, many fathers prohibited their daughters from learning to write, and the only books to be had were those of a devotional character and the lives of the saints. Despotism feared light, and books not approved and selected by the ecclesiastical authorities were strictly forbidden.

It is easy to see that public instruction was very limited and little encouraged. The city of Sucre, capital of Bolivia, known in colonial times as Charcas, had an university and was the residence of the Royal Audiencia, whose jurisdiction extended over all the territory that today constitutes Bolivia, and it was at the same time the highest tribunal of justice and the delegated authority of the king in administrative affairs.

THE WAR FOR INDEPENDENCE

Thus, under the reign of absolute submission to the crown of Spain and its representatives, the colonies of South

America lived condemned to inaction and outside of the march of progress of the world, until the social upheaval known as the French revolution changed the basis of modern society and made its influence felt in the far-off Spanish colonies.

Contemporaneously the English colonies of North America had won their independence and organized a federal republic, destined to become the greatest example of popular government and a complete demonstration of the life-giving influence of democracy.

These great historic events encouraged the Hispano-American colonies to fight for their freedom, which they had longed to attain.

The invasion of Spain by Napoleon and the capture of Ferdinando VII offered a favorable opportunity for a general uprising. The city of La Paz was among the first to openly proclaim independence, and on the 16th of July, 1809, organized a Junta Fuitiva, called to advance the noble work of political redemption of all the continent.

Spain tried to drown the revolution in blood, and committed the most atrocious deeds. The chiefs of the revolution were condemned to death, and, as a lesson and warning, their bodies were quartered and placed on poles along the public roads.

The hour of regeneration, however, had arrived, and nothing could stop the efforts of a people determined to secure their freedom. The stubborn fight continued for fifteen years. The territory of Alto Peru, now Bolivia, was the theater of daily combats, and there was not a village or piece of ground that was not consecrated with the generous blood of her sons fighting for liberty. As illustrating cruelties perpetrated by the Spaniards, it is stated that once they entered the city of Tarija carrying on their lances the heads of the patriots killed on the field of battle.

The victory of Ayacucho, on the 9th of December, 1824, won by the Venezuelan General Antonio, José de Sucre, terminated the war, and thus the South American countries secured their emancipation.

The provinces of Upper Peru held the first national congress in Sucre, and on the 6th of August, 1825, was proclaimed and established the Republic of Bolivia.

UNHAPPY BECAUSE OF MILITARY PRESIDENTS

The independent life of Bolivia began under auspicious circumstances. Under the enlightened guidance of Sucre, the victor of Ayacucho, a hero illustrious for his virtues, his love of progress, as well as his deep respect for the law, the Republic without doubt might have advanced rapidly toward the path of freedom and order; but unfortunately a military insurrection, prompted by intrigues of neighbors and personal ambitions, although condemned by the whole country, caused the resignation of the presidency of Sucre.

He was succeeded by General Santa Cruz, who, called by one of the factions in which Peru was divided, invaded that republic and organized the Peru-Bolivian Confederation. With the title of Supreme Protector, he occupied with Bolivian troops the capital of Lima, where he fixed his residence; but, owing to the opposition of the contrary bands, aided by Chile, fearful of the increased power that the Peru-Bolivian Confederation might develop, put an end to it in a few years.

With Santa Cruz began the sad period of military chiefs and the efforts of the people to free themselves by the disastrous remedy of revolution, whose fatal influence was shown when, weakened and divided by our internal dissensions, we were worsted in the war with Chile.

The disasters and losses resulting from this war awakened the patriotic sentiment of the nation, and then the Bolivians undertook to repair by peace and work the losses caused by anarchy.

Today the country is peaceful, under a free government elected by popular vote,

and endeavoring with all of her energies to develop the riches with which Providence has endowed her soil.

If I have not tired your kind attention I will draw a rapid sketch of the present conditions of my country, her government, and the work being done to make productive the mineral and vegetable wealth of her territory.

THE GEOGRAPHY OF BOLIVIA

The great geological disturbances that in remote ages transformed the continent of South America and produced the wonderful upliftings of the Andes are very marked in Bolivia. This mountain chain, traversing the whole length of the continent, divides itself in Bolivia into two principal branches—the one of the west, forming a kind of wall between the sea and the interior, closely follows the coast; the other, extending toward the east and known as the Cordillera Real, presents a series of majestic peaks eternally resplendent in crowns of snow and lifting their heads to heights of more than 21,000 feet, as the Illimani, and the Illampu, with 21,700, and others equally imposing.

The high plateau of Bolivia occupies an area of more than 66,000 square miles, with a mean altitude of from 10,000 to 13,000 feet above sea-level. It is difficult to say whether the obstacles offered by the vast mountain walls to free traffic and the communication of the people is not more than compensated by the prodigious quantity of minerals they contain, and that make Bolivia one of the richest countries of the globe.

The forests and vast plains extending eastward, with about 7,000 miles of navigable rivers, comprise a fertile agricultural territory embracing more than 300,000 square miles.

The total area of Bolivia is more or less 709,000 square miles, and it is therefore the third nation of South America, as regards size; but unfortunately the population does not yet correspond to its extensive territory, amounting only to a little more than 2¼ millions.

As the Spaniards settled first in the mining regions, the section of Bolivia situated east of the Cordillera Real, which includes the extensive territories watered by the tributaries of the Amazon and the Plata, is the least populated. There are found the forests, filled with fine woods suitable for all industrial purposes, such as railway ties, building and cabinet-making. Some of these woods are as hard as iron. Rubber, Peruvian bark, and a multitude of useful and medicinal plants abound in this soil, whose wonderful fertility could easily support many millions of inhabitants. The coffee and cocoa are conceded to be of the finest quality, and fruits and all tropical products are abundant. The climate is generally healthful and suitable for settlement by European races.

The mean temperature of the lowlands of the Amazon to an altitude of 2,000 feet above sea-level is 74°; to an altitude of 8,000, it is 66°; and in the central plain, where the altitude varies from 10,000 to 12,000 feet, it is 50°. It is calculated that to every 181 meters of ascent in the mountains there is a drop of one degree in the temperature.

It may be said that in Bolivia there are only two seasons—the rainy season, which corresponds to summer, and extends from December to May, and the dry, or winter, season, lasting from May to December. In the latter months it seldom rains and the sky is clear and bright. The rains are more copious in the east, and at times the rivers overflow and rise as high as ten meters above their ordinary level.

Almost all of the navigable rivers of Bolivia flow into the Amazon, the most important being the Beni, which receives the Madre de Dios, the Orton, and others before reaching its confluence with the Mamoré, when it takes the name of Madeira, one of the most powerful tributaries of the Amazon. Unfortunately the navigation of this great river is obstructed by a series of very dangerous rapids. The government of Brazil has agreed by treaty to construct a railroad

around these rapids and thus expedite the Amazon route. The Pilcomayo and the Bernejo are also rivers of importance that flow toward the southeast and empty into the Paraguay.

The eastern region of Bolivia is also rich in grazing lands, where the stock industry promises to be highly lucrative. Today there are found vast herds of wild cattle roaming over the lands.

Lake Titicaca, on the boundary line between Peru and Bolivia, is notable for its great altitude, for its romantic traditions, and for the monuments of that distant epoch yet standing on the Island of the Sun. The lake's surface extends over an area of more than 5,200 square miles.

If the natural exuberance and richness of the eastern section of Bolivia is remarkable for its products, the region of the Cordilleras is, I will say, the great storehouse of mineral wealth. The silver mines of Potosi, Oruro, Colquechaca, Huanchaca, and many others have contributed hundreds of millions to the richness of the world. No less abundant are the deposits of copper, bismuth, zinc, cobalt, gold, and tin. On speaking of the commerce of Bolivia I will mention the quantities of these minerals exported today.

THE COMMERCE OF BOLIVIA

The main causes that hinder the development of Bolivia's wealth are: The difficulty and cost of transportation, the lack of capital, and the scarcity of population. To what an extent the high rate of freight hinders the growth of industries in Bolivia, it is enough to state that coal at the seacoast is worth from 18 to 25 shillings, or, say, $4 to $6, more or less, per ton; taken to the mines in the interior of Bolivia, according to the distance, yet this may not exceed five hundred miles, and the price will be from $40 to $80.

A large number of mining enterprises, as well as the eight banking institutions, are financed with national funds. Recently two German banks have been established in La Paz.

The constitution of Bolivia is very liberal and is based on the unitarian system of central government. The President is elected every four years by direct popular vote. The legislative power is exercised by a senate and house of deputies, and the judiciary by a supreme court appointed by the senate, and by inferior courts and other judges.

Foreigners enjoy the same franchises as the natives, and may hold property, work the mines, etc., all in conformity with the laws.

Bolivia is the only country in South America that has not suffered from earthquakes, and when felt they were almost imperceptible and of no consequence.

Within the last few years the international commerce of Bolivia has increased considerably. In 1905 it reached 69,665,000 in Bolivian money—an increase of thirty per cent over the figures of the previous year—and according to the statement of President Montes in his last message to Congress, in 1906 it will reach 80 millions, and when the railroads now in course of construction are completed these figures could be easily doubled in a short time.

The commerce with the United States has also grown in recent years, and the construction of the railways will greatly augment the present movement. The importations into Bolivia in 1905 amounted to $1,720,000; and yet this small sum is a large increase compared with previous years. On the other hand, the importations of Bolivian products into the United States hardly reached $60,000, while Bolivia produced rubber, tin, cocoa, coca leaves, Peruvian bark, and many other articles of great consumption in the United States, and which are purchased in Europe to be brought here.

The exportation of silver averages 13,000,000 ounces a year; of copper, 5,000 tons, more or less; the production of tin grows from year to year, so that from 1897, or ten years ago, when the production was about 3,000 tons, it had reached 17,000 in 1905, and during the

past year it is probable that the exportations exceeded 20,000 tons of pure tin.

It is impossible to foresee the marvelous development that railway facilities will offer to this industry, as well as to the general progress of the country. Bismuth, zinc, and gold represent quantities no less important.

In spite of all the obstacles that the Bolivian industrials have encountered on passing through the Amazon, the exportation of rubber in 1905 amounted to 1,700,000 kilos. This is a product whose output could be easily increased when the railroads are completed. Sir Martin Conway calculates as not improbable that there may be about 50 millions of rubber trees in the region of the Upper Beni alone. Each tree is supposed to yield annually from three to seven pounds of rubber. Bolivia also exports considerable quantities of alpaca wool, the finest chinchilla and vicuña skins, and other national products.

The position Bolivia occupies in the heart of South America gives to her commercial and international importance, and, although deprived of her coast on the Pacific, she is in immediate contact with five of the most advanced republics; and it is to their interest to encourage mutual trade for the benefits that will naturally result. And this is not all. The main railway line under construction in Bolivia has a continental bearing, for the connection that it will establish between the Argentine system, that is now being extended to the interior of Bolivia, with the Peruvian railroads coming from the north and the Pacific coast. Then Lima in Peru, La Paz in Bolivia, and Buenos Aires in Argentina will be united within a few years by a continuous railway spanning the 2,500 miles, more or less, that separate the capital of Peru, on the Pacific, from the capital of Argentina, on the Atlantic, and will form an important section of the Pan-American Railway.

For the first time United States capitalists are taking an interest in the construction of railways in that section of South America. The Argentine roads were built with English capital, and the same is the case with those of Brazil and Chile, where the majority of the roads are government property. Peru constructed her railways with national funds, but had to cede them for a term of years to her English creditors. Bolivia, then, is the first country where, in coöperation with the Bolivian national resources, American capital is being invested.

NEARLY 1,000 MILES OF RAILROADS TO BE BUILT BY AMERICAN CAPITAL

It has been my aim and I had the good fortune to succeed in interesting representative New York bankers in the great work of giving life to my country by means of roads through rich deposits of minerals and open to the world her virgin forests. My government has concluded directly with the bankers a contract that is today being executed. The lines to be constructed by the American syndicate are from La Paz to Tupiza, 530 miles; Oruro to Cochabamba, 133 miles, and La Paz to Puerto Pando, 200 miles; in all, 863 miles. Of these railroads the one from La Paz, passing by Oruro and Potosi to Tupiza, will form the chain uniting the republics of the Pacific with those of the Atlantic, besides traversing the richest metallic zone that exists, perhaps, in the world. The line from Oruro to Cochabamba will open to commerce the fertile valleys of the interior of that section, the most thickly populated of Bolivia, and make that part of the country accessible to the navigable branches of the Mamoré.

The railroad from La Paz to Puerto Pando, a port situated at the headwaters of the Beni, will open the territories of the Beni, where rubber grows in such abundance, coffee, and all the most precious tropical products, as well as the various classes of woods. This railroad will have the peculiarity of passing in a few hours from the frigid zone of the high plains, where there is practically no vegetation, to the tropical region of the orange and the sugarcane. In a distance

Rubber Gatherers in Bolivia

For this illustration and the three following pictures, the NATIONAL GEOGRAPHIC MAGAZINE is indebted to the Commercial Museum of Philadelphia

Tapping the Rubber Tree in Bolivia

of less than thirty miles the traveler will be transported, as if by magic, from a temperature of perhaps 40° or less to one of 70° or more, as he descends through wonderful scenery to the other side of the great eastern chain of the Andes.

But these railroads are not the only ones called to transform in some years the economic life of Bolivia and give to her rank and importance to which her size and position entitle her. By a treaty of peace recently celebrated with Chile, that republic agrees to build, and work has already commenced, a railroad from Arica to La Paz, a distance of some 309 miles. That line will unite Bolivia with the Pacific by a road much more direct than that at present afforded by the Antofagasta line, which is 575 miles long, or that from Mollendo to La Paz via Lake Titicaca, a distance of 533 miles. The Arica road will bring the city of La Paz within 8 or 10 hours' time of the coast.

The Bolivian Congress authorized more than a year ago the building of a railway from the borders of the Paraguay River to Santa Cruz, one of the most mediterranean cities, but destined to become one of great importance. The projectors have deposited the sum of 100,000 pesos as a guarantee for the execution of the contract, and the construction materials have begun to be transported by way of the Plata and Paraguay Rivers. The length of this line will be 497 miles. This route will offer free communication to the rich oriental zone by way of the Plata and the Paraguay, and open to immigration and progress a territory of more than 242,000 square miles, watered by large rivers and of remarkable fertility. There are on foot other projects of railway construction of no less importance.

Progress is like oil, which spreads itself wherever it touches. Some years more of work and effort in preparing transportation facilities, and by the beneficial influence of steam, electricity, and immigration, the future greatness of Bolivia is assured.

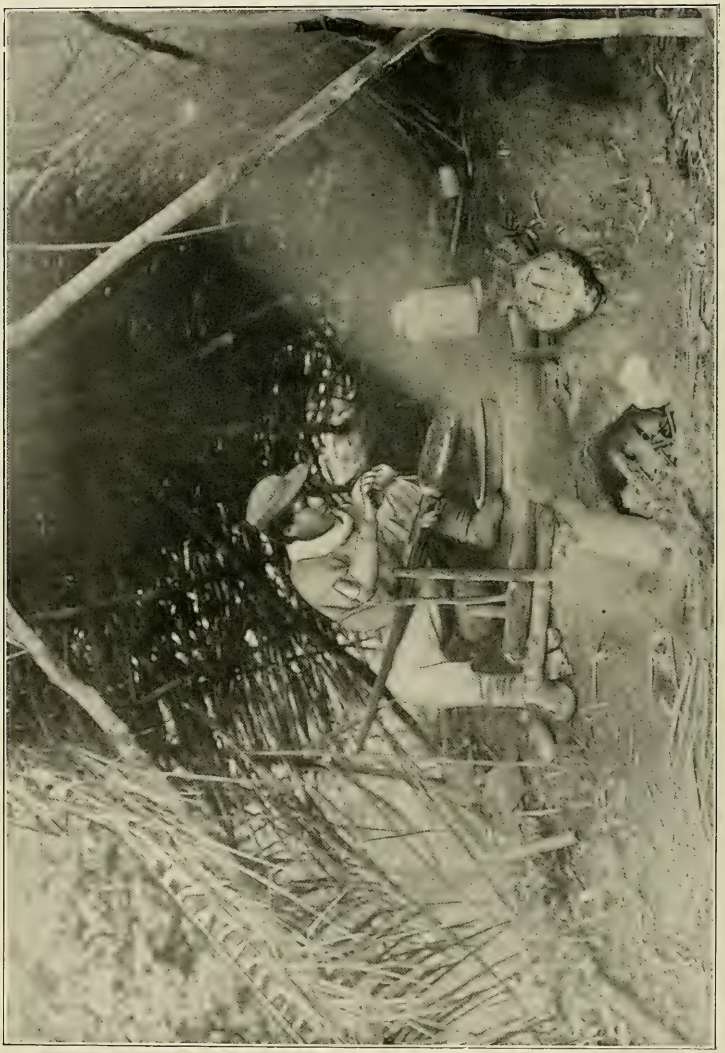
THE GLORIOUS FUTURE OF SOUTH AMERICA

Before concluding this already too long address, permit me to call your attention to the fact that what is being done in Bolivia is also in progress in the majority of the South American republics. Argentina, for instance, by receiving an increasing current of immigration, is rapidly developing her wonderful resources. If some of them have not yet succeeded in getting over the fatal disease of internal turmoil, it will not be long before they enter the road of order, and Mr Root's prophecy that the twentieth century will be South America's century will be fulfilled.

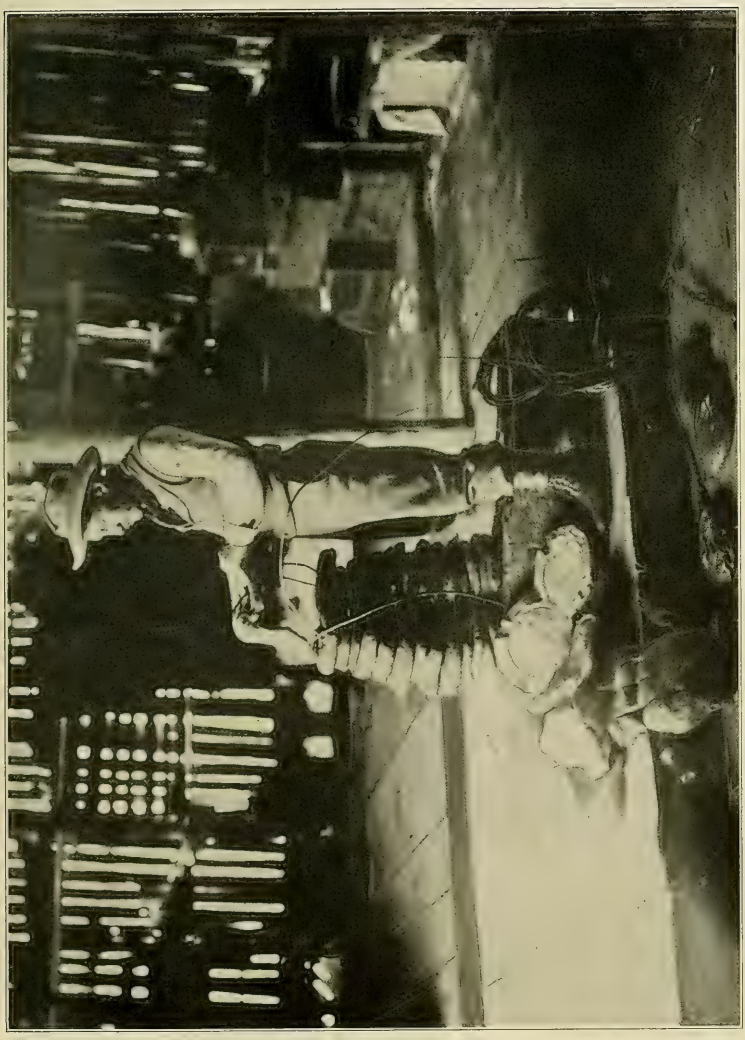
Slowly but surely the onward march of progress brings closer and closer the South American republics, guided by the eternal force of liberty and the broadest sentiments of universal fellowship, common origin, and interests. I venture the hope that in no distant future a confederation of Peru, Bolivia, Chile, Argentina, Uruguay, and Paraguay, as the United States of South America, will be established, and that Ecuador, Venezuela, and Colombia, reunited, and Brazil will form a trinity of nations that, with their sisters of the North, will be the beacon light of the world, shining with the undimmed brightness of human rights, peace, and happiness.

Asia is already populated with many hundreds of millions of people whose races, civilization, and traditions will never, perhaps, assimilate with those of Europe; Africa has been carved among the powers of Europe; this New World, then, remains, where the political traditions of the Old World are broken and democracy will be supreme.

Never was there proclaimed a more vital, lasting, or grander principle than the Monroe Doctrine, which, in its purest interpretation, is the consecration of all America to republican life; that is to say,



Curing Rubber by Smoking it, Bolivia



Packing-room of a Rubber House, Bolivia

the dignification of man and the empire of justice and the right to work out his own destiny without the tutelage of kings or classes or any other sovereignty than that of citizen and ballot.

We are thankful and render our tribute of admiration to the history and civilization of Europe; we study the books of her thinkers; enjoy the magnificent works of her artists, of her poets, and of all those who have so highly elevated the intellectual level of mankind. We desire and solicit the concourse of her noble races; but in the political order the whole America is destined to be the throne of liberty and right, where mankind will advance to the highest ideals of his divine mission in the world. And when the barrier separating this grand Republic from her sisters of the South is removed by the completion of the Panama Canal, the two great oceans made one, it is necessary that the bonds of union and of mutual interest and respect be already established on the firm basis of peace and justice.

The Panama Canal will open a new horizon to commerce, and it might be said that it will be the material consecration of the Monroe Doctrine, which excludes conquest from America, where, under the inspiration of democracy, freedom, and justice, the Christian brotherhood of mankind will be perpetuated.

OUR HERALDS OF STORM AND FLOOD*

Being an Account of the Various Activities of the United States Weather Bureau in Saving Life and Property

By GILBERT H. GROSVENOR

WE Americans are always talking about our mountains of gold and coal and iron, of our fat fields of corn and wheat, but few of us ever realize that we have in our climate a great advantage over all other nations. In the cold wave which in summer and winter so often sweeps across the land and sends the thermometer tumbling thirty degrees in almost as many minutes, we have a constant, a never-diminishing asset of priceless value. The wave acts as a tonic, but, unlike any tonic made by man, it carries no reaction. No other land has cold waves like ours. To the cold, dry air of this periodic cold wave, which brings extraordinary changes of temperature, we owe much of the keen, alert mind, the incessant, unremitting energy of our American race. I had asked the Chief of the United States Weather Bureau, Professor Willis L. Moore, what was the most remarkable feature of our climate, and that was substantially his reply.

When the amazed European asks us what makes the sluggish mind of the immigrant to stir and waken in the United States, and then to climb, at first hesitatingly, but soon with vigor and confidence, to the top round in the ladder of success, we are accustomed to reply, "It's

* This article is reprinted from *The Century Magazine* by courtesy of the Century Co., and is here given as one of the series in the NATIONAL GEOGRAPHIC MAGAZINE describing the work of the scientific departments of the United States government, other articles in the series being "Millions for Moisture" (describing the work of the United States Reclamation Service), "Reclaiming the Swamp Lands of the United States," "Our Fish Immigrants," "Saving the Forests," etc., etc. The article and illustrations are copyrighted by the Century Co.

in the air;" and we are right. The spirit which fired our fathers to cross the wide Atlantic, and which in less or equal degree still animates the thousands annually seeking our shores, is fed and fanned by the cold winds from the northwest.

The cold wave is born in the heavens scatters the foul, logy, breath-soaked atmosphere in our towns and cities, and puts ginger into the air. We fill our lungs with it and live. New waves are always coming, following each other in regular procession like the waves on a seashore.

From a photograph. Copyright by Clinedinst, Washington, D. C.

Willis L. Moore, LL. D.

Chief of the United States Weather Bureau since 1895, President of the National Geographic Society since 1905

miles above our heads, usually over the Rocky Mountain plateau. Suddenly a mass of bitterly cold air will tumble down upon Montana. It rushes down as though poured through an enormous funnel. As it falls it gains momentum, and, reaching the earth, spreads over the Mississippi Valley and then over the Atlantic states, covering them like a blanket. It

It is fitting, then, that meteorology, the science of the weather, should be a distinctly American product, and that the people of the United States should have the best weather service in the world. The United States government spends $1,500,000 a year on its Weather Bureau, which is more money than all the governments of Europe combined spend

Photo by H. C. Frankenfield

Wreckage at Kansas City, Missouri, after the Subsidence of the Kansas River Flood of 1903

for similar service. It has a staff of many hundred skilled experts and trained observers, who in all parts of the country are constantly on the watch to see what the heavens will bring forth.

A DIVIDEND OF TWO THOUSAND PER CENT

Probably ninety-nine men in one hundred judge the Weather Bureau by the weather forecasts which they read at the breakfast table in the morning paper. They execrate and ridicule the service when they are caught at their office or at the theater unprepared for an unheralded shower, and as likely as not unhesitatingly assume to themselves the credit when the forecast is right. Will it be fair or will it rain? How hot or how cold has it been today? They believe the Weather Bureau was created to answer these questions correctly, and always correctly, for their personal gratification. They do not know that the local weather forecasts are only a fraction of the work and a very small and unimportant fraction at that.

Some time ago a skeptical insurance company determined to investigate the amount of property saved in one year by the warnings of the Weather Bureau. It was a company of conservative men, whose estimate would be under rather than above the truth, but it found that on an average the people of the United States saved every year $30,000,000 because of their weather service. As the people contribute $1,500,000 every year to its support, this means that they get annually a dividend of 2,000 per cent on the investment. An investment in

which the original capital is paid back twenty times over in twelve months is extraordinarily profitable and well worth investigation. How does the Weather Bureau do it?

As it is impossible in one brief article to describe all the branches of the weather service, which reaches intimately about one-half of our population every day, I shall cite only a few of the more striking phases of its work.

WATCHING OUR TURBULENT RIVERS

The eagle watch kept on our turbulent rivers to see that they do not catch unprepared the people living on their banks, or on the low-lying lands near them, is one of the most dramatic phases of the work of the weather service. By long experience and close calculation, the weather-man has learned to read the symptoms predicting a rise or fall as accurately as a physician can count the heart-beats of his patient with his finger on the pulse; he has posted hundreds of rain-gages throughout the land feeding each river, which, like sentinels, tell him when the rainfall has been heavy and the exact number of inches of rain that have fallen. To find the amount of water that will pour into the river is then simply a matter of arithmetic, as he knows the number of miles drained by each river. He knows how much water the river bed can carry in a given time as nicely as his wife can judge the contents of her coffee-cup. He knows the strong and weak points of the river banks, so that if the skies send more water than the river bed can carry, he can predict where the waters will overtop or burst its banks and drown the farmer's cattle or flood the city streets.

One of the most remarkable cases of flood prediction on record was the warning of the disastrous floods of 1903. Twenty-eight days in advance of its coming, the forecaster at Washington announced the exact time when the crest of a flood would reach New Orleans, and said that the height of the flood would be 21 feet. Punctually to the hour the flood came, and its crest was 20 feet 7 inches, only five inches less than the height predicted. The immense ocean of water had started one thousand miles away. It had dropped from the skies over a territory six times larger than the State of New York (over 300,000 square miles); but the weather-man knew its rate of march as surely as the engineer, with his eye on the indicator, knows the speed of his locomotive. The people at Memphis were warned that the waters would rise to 40 feet and overtop their levees, and they were given seven days' notice. The people of Cairo were told to prepare for a height of 50 feet; but as they were nearer the starting point of the flood, they received only four days' notice. Such seasonable warning gave time to the people to prepare for defense. Thousands of men were set to work to raise and strengthen the levees and embankments, to clear the wharves and river banks, to remove women and children, to drive the cattle to places of safety. When the flood arrived, the people were ready for it. Comparatively few lives were lost, and the damage to property, while terrible, was millions and millions of dollars less than it would have been if the people had had no sentinel to cry out the march of the waters.

The devotion of the dike-watchers of Holland has been the theme of children's stories for generations, but the sleepless watch of the hundreds of Weather Bureau observers when a flood threatens the land passes unnoticed and unpraised. The scientific precision of American science has made the work appear so simple that it has been robbed of its romance.

FROST AND COLD-WAVE WARNINGS

Much of the care of the Weather Bureau has been devoted to developing a perfect system of frost and cold-wave warnings. A blighting frost or withering cold wave in early spring or autumn may leave behind blackened orchards, wilted vegetable gardens, and empty pockets. In a night it may destroy the

prospects and hopes of the year. The cunning and tireless perseverance of modern science has found some ways of thwarting the malicious designs of King Frost. The orange-grower of Florida has devised dresses to wrap around his orange trees; the cranberry-grower of Wisconsin has learned to flood his cranberry marshes and thus keep them warm; the truck-growers of Norfolk cover their early strawberries and late lettuce and celery with spreads of cheese-cloth or screens of slats; the grower of sugar-cane in Louisiana also has his methods of frost protection.

But all these shields against the biting of the frost are worthless unless the farmer is warned in time to prepare for the icy visitation. The Weather Bureau aims to give him this warning at least twenty-four hours in advance, and to this end it has developed one of the most perfect organizations in the world for distributing knowledge. When the weather-observer scents a frost in the air conditions of a certain region, or sees a cold wave marching to invade a certain section, he immediately telegraphs to the principal town or city in that region. Thence the warning is sent by special messengers, by telegraph and telephone, to every producer in the threatened region. Telegraph, telephone, and railroad companies join hands with the weather-man to help distribute the warning. More than one hundred thousand telegrams alone are sometimes sent within a few hours. Freight trains are placarded with giant signs which farmers can read far off; in some regions the farmers are warned by a code of whistles from the passing locomotive. In the cold wave of 1898, $3,400,000 worth of fruits was saved by the weather forecasts.

STORM WARNINGS

Undoubtedly the features of the Weather Bureau work which yield the highest returns on our investment are the storm warnings sent to masters of steamers and sailing craft in our ports. We who live in tight city blocks and but rarely venture on the ocean know little of the terrors of a storm. The wind that whistles down the street, snatching off our hats, or that rattles our blinds most provokingly at night, may mean a gale at sea of from forty to sixty miles an hour. Between October and April our coasts are swept repeatedly by mighty storms which are hungry for victims, while often during August and September a West Indian hurricane may tear up the coast. The captains of the hundreds of sailing ships, coal-barges, and coast-wise craft that carry ice, coal, fruit, and lumber from port to port, know too well the dangers of being caught in such a storm, for our coast-line contains more than one Cape Fear, pointing like a dagger at every passing vessel. The Weather Bureau learns from its outposts as soon as a storm enters the horizon of the United States, and sends warning to the ports in the threatened region. Storm-signals are hoisted on the watch-towers. The seamen and ships keep snug in harbor while the tempest rages outside. An idea of the commercial value of the warnings may be gathered when we remember that during every year not less than 17,000 vessels, most of them small, and many of them easy prey for storms, leave our ports between Portland and New Orleans. These storm-signals are also posted in all the ports of the Great Lakes, which are noted for the fury and suddenness of their storms. Formerly 75 per cent of the loss in shipping on the Great Lakes was wrought by storms, whereas now, owing to the efficiency of the storm warnings, less than 25 per cent of our annual loss can be attributed to the work of storms. Forty-five minutes after the dictation of a storm warning by Chief Moore at Washington, the warning is placed in the hands of every sea captain in every lake and ocean port of the United States.

THE RECORDS—A MURDERER DISCOVERED

The records of the heat of summer and of the cold of winter kept by the Weather Bureau serve a useful purpose. Builders

Photo by H. C. Frankenfield

Scene in Railway Yard, Kansas City, after the Visitation of a Flood

A Fog Billow, San Francisco

Photo taken from U. S. Weather Bureau station, on summit of Mount Tamalpais, by Prof. Alexander McAdie

of giant steel bridges or steel sky-scrapers consult them to see how much they must allow for the expansion and contraction of the steel used. Lawyers consult them to establish or to break down a witness's testimony. Not long ago a man was on trial in Illinois, accused of murdering an aged woman. He was unable to prove an alibi, and it looked as if he would be convicted. The principal evidence against him was that of a laborer, who on the day of the murder had been digging a ditch opposite the house where the murder was committed. The laborer stated that he had climbed out of his ditch about eleven to take a drink from his bucket; he remembered the exact hour because he had looked at his watch at the same time to see how near it was to dinner-time. Glancing across the street, he was horrified to see, through the open window, the prisoner striking the woman. Before he could get to the house the assassin had fled; but his identification had led to the arrest and was now threatening to hang the man.

The evidence was straightforward and seemed conclusive. The prisoner's lawyer, however, shrewedly consulted the records of temperature kept by the weather station, and found that on the day of the murder there had been a cold spell of such severity that if the bucket of water had remained out all the morning, as it did, according to the witness's story, the water would have been a solid chunk of ice by eleven o'clock. This discovery led to the acquittal of the prisoner and subsequently to the arrest of the ditch-digger, who, it developed, was the real criminal.

CROP BULLETINS, BALLOON RECORDS, ETC.

The Weather Bureau is doing much work that there is not space to describe. It issues weekly crop bulletins, summarized from the reports of many thousand observers, telling how the rain or drought, or cold or heat, has affected the wheat, corn, and other crops. It issues snow bulletins in the West, telling how much snow has falen in the mountains, and hence how much water may be expected during the summer for the irrigation works. It publishes special rain forecasts in the raisin districts of California, which give the farmer time to get his trays of dried raisins under shelter before the deluge. It has recently made plans for the exploration of the upper air by balloons. A self-recording instrument of extreme lightness, invented by Mr C. F. Marvin, of the Bureau, is attached to a small rubber balloon and set loose. The balloon shoots up four or five miles, getting larger and larger as the pressure of air diminishes, until it finally bursts. The fall immediately opens a parachute, upon which the instrument floats down very slowly, recording the character of the air as it descends. The plan is to liberate several hundreds of these balloons simultaneously in different parts of the country. As a reward is offered for their return, and as they make very conspicuous objects in the sky, the Weather Bureau hopes to recover most of the instruments, and thus obtain facts about the upper-air currents which are most important and little understood.

Chief Moore also plans, through the development of wireless telegraphy, to get weather reports from steamers in mid-ocean. He has for years urged the countries of Europe to take simultaneous international observations; for meteorology is not bounded by political geography, but is an international science. He also wages a ceaseless war against the so-called "long-range" weather prophets, the charlatans who are continually humbugging credulous people.

Professor Willis L. Moore, Chief of the United States Weather Bureau, entered the service in 1877. He began at the bottom. By hard work, study, and natural ability he won steady promotion, and in 1895 was appointed head of the service by President Cleveland.

We are more interested in, or at least we talk more about, the daily weather—the health of the earth, it might be called—than of any other subject. "It's rather windy today, isn't it?" is the salu-

tation of one gracious lady to another at the afternoon tea. "A fine morning," shouts one teamster to his fellow. The weather plays a most important part in our feelings, and is very often the key of our high spirits or our deep depression. All of us recognize this influence of the weather, and this is probably the reason why every one, of high or low degree, be he savage or civilized, passes a remark about the day to whomever he greets.

But though the weather is the most general subject of conversation every day in the year, though we hear more remarks about this topic daily than about any other, most of us are absolutely ignorant of this great, mysterious, fascinating force.

EVERY MAN HIS OWN WEATHER PROPHET

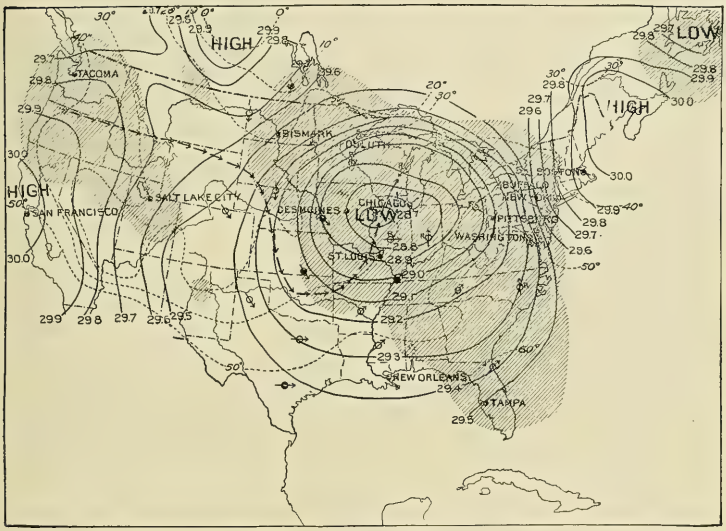
The Weather Bureau is educating the people to a better comprehension of the weather. It puts forth scientific treatises, of course, but it goes further, and publishes popularly written accounts and interpretations of the weather phenomena. These it distributes widely, as far as its appropriation will permit. One of the most valuable educational publications is the daily weather map. The map gives a picture of the snow, the sunshine, the heat, the winds, of the entire country. It tells who are shivering, who are mopping their brows, who are carrying umbrellas. By reading the conditions, the movements on the map, we can tell for ourselves when our turn to shiver or swelter will come.*

The weather map is an instantaneous photograph of the weather of the three million square miles of our United States. This photograph is taken every morning at 8 a. m. (75th meridian time) and every evening at 8 p. m. Precisely on the hour an observer at every one of the two hundred stations scattered over our states makes his barometric, thermometric, wind, rain, and other observations, and prepares his report for his section. By half-past eight all these reports are speeding to Washington, with right of way over all telegraphic business. The experts at Washington on receiving them, at once develop the photograph.

This map or photograph is the basis of all of the forecasts and of all of the work of the Weather Bureau, and knows no Sunday and no holiday. Washington is the central station from which all the principal forecasts are sent out. From six substations—Chicago, Boston, New Orleans, Denver, San Francisco, and Portland, Oregon—local forecasts are issued. The forecasts, made for thirty-six or forty-eight hours, are sent to all the daily papers, morning and afternoon, and are published in every one of our twenty-five hundred daily newspapers. They are also telegraphed to more than two thousand principal distributing points, whence they are again telegraphed or telephoned or sent on postal cards to thousands of business exchanges, post-offices, public libraries, etc., where they are posted in prominent places. In the middle West, from Ohio to Nebraska, 600,000 farmers obtain the morning weather forecast by telephone thirty minutes after it is issued. The experiment of sending the forecasts to farmers by rural delivery has been successfully begun. Already more than 100,000 farmers daily receive the weather reports in this way in less than six hours after the forecast is issued.

By studying the daily weather maps distributed by the Weather Bureau, any one can learn a great deal about the weather, and in a short while can become a fairly good weather prophet. Take the accompanying weather map as an example. The storm represented on this map was one of the most remarkable that ever swept across the United States. It was born and nursed in the mid-Pacific until

* The United States Weather Bureau has recently published an interesting little book entitled "Weather Folklore and Local Weather Signs," by Professor E. B. Garriott, which in simple language gives much information about the weather and the means by which the public may forecast the weather. It contains also a collection of weather proverbs. The book may be obtained from the Weather Bureau (Washington, D. C.) for thirty-five cents.



A Typical Weather Map

The solid lines are isobars; the broken lines are isotherms. The shaded portion of the map indicates the area over which precipitation has occurred during the twelve hours preceding 8 A. M., 75th-meridian time. The arrows point in the direction the wind is blowing.

it grew to immense proportion. Thence it dashed upon our western coast, almost simultaneously striking California, Oregon, and Washington. It swept over the Rocky Mountains as if they were a five-foot fence, dashed over Wyoming, South Dakota, Nebraska, Kansas, Oklahoma, Missouri, Illinois, and Wisconsin, and finally disappeared in the Great Lakes four days after its entrance. A storm like this revolves all the time it is advancing. It moves like a spinning plate flung across the room,* or like the top which the small boy shoots spinning across the sidewalk; in fact, the storm is a gigantic top about a thousand miles in diameter and several miles high.

This map illustrates perfectly the different kinds of weather that such a great cyclone will bring. As the storm advances, it brings a deluge of rain or snow, but it restores the sunshine before it disappears. The reason is as follows: The wind in the front half of the cyclone is from the south, and as this warm wind comes into colder latitudes, it cools, and the moisture in it is condensed, so that we have rain and snow-storms. The wind in the rear half of the cyclone is from the north, and is thus cold; as it comes into warmer latitudes, it grows warmer and is able to absorb the moisture in the air, so that we have clearing weather.

Such a cyclone may be generated by the clashing of two antagonistic currents of air, one current coming perhaps from the south and the other from the north. As the two currents wrestle, they are caught by the never-ending stream of at-

* The cyclone revolves in a direction opposite to the hands of a watch.

Photo by Prof. Alfred J. Henry

Cirrus Clouds Merging into Cirro-stratus

This is a transitional form often seen when rain or snow is approaching. The cloud layer gradually thickens until the sky is obscured

Photo by Prof. Alfred J. Henry

Broken Cumulus Clouds

These are signals of unstable atmospheric conditions

From a photo by Prof. Alfred J. Henry

Cirro-cumulus Clouds

These are typical fair-weather clouds, and are usually seen at an elevation of four or five miles

From a photo by Prof. Alfred J. Henry

Cirrus, the Highest-flying Cloud

Clouds of this nature float at an elevation of from four to ten miles. When they look like plumes with frayed and torn edges, increased cloudiness and rain or snow may be expected.

From a photo by Prof. Alexander McAdie

Ocean Fog Pouring in over the Hills upon San Francisco

mosphere, which is moving easterly miles above our heads, and are swept across the continent as an eddy is borne along on a river. The Weather Bureau is learning a great deal about these important upper-air currents by studying the different types of clouds, and by noting their altitude and rapidity of motion.

"STORM SIGNALS OF THE SKY"

It has been well said that "clouds are the storm signals of the sky." The

From a photo by Prof. Alexander McAdie

Sea Fog Lifting and Changing to Clouds, San Francisco Bay

amateur, by watching the clouds scudding or drifting miles above, can often make a pretty sure guess of the coming day. The pictures accompanying this article illustrate the principal kinds of clouds and their significance. They are very remarkable cloud photographs, and were taken by Alfred J. Henry, Professor of Meteorology of the U. S. Weather Bureau, and one of the most successful forecasters in the government service.

STUDYING THE SUN

Not a single storm has swept across the United States or up or down its coastline within many years that has not been heralded hours or days in advance by the Weather Bureau. Nor has the service allowed a cold wave or a flood to catch us napping. But the Weather Bureau is ambitious to do more than this. It feels that its present knowledge is too much like that of a man who sees a wild engine tearing down the track and telegraphs ahead for everything to keep out of its way. It desires to know why these great cyclonic storms are conceived and the processes of their conception. But before it can get this knowledge it must obtain a better understanding of the sun, which is the initiating cause of all movements of the atmosphere affecting the weather.

From a photograph

Buildings Burst Open by the Explosive Effect of a Tornado, Louisville, Kentucky—the Windows and Walls Flying Outward

From a photograph

The Jumping Characteristics of a Tornado, Louisville, Kentucky

The building in the center of the block is shattered, while the adjoining buildings are barely touched

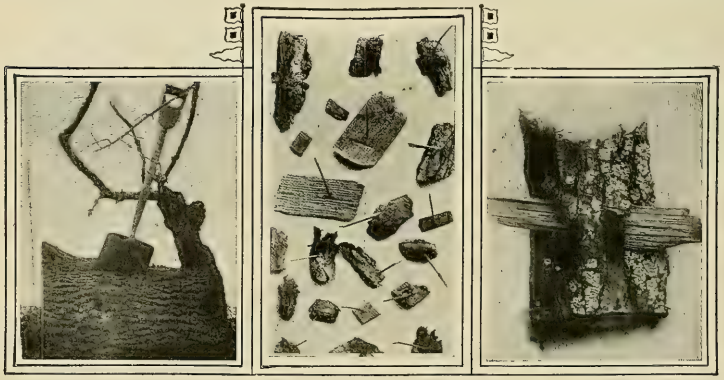
The sun is the prime cause of every change of weather. The sun determines whether the earth shall be hot or cold, just as our hands turns on or off the register. Absence of sun's rays makes the North Pole a continent of ice; plenty of sun's rays makes the Equator a furnace. The sun's rays, by heating one land more than another, cause winds, hurricanes, and cyclones. The heat in the

sun is so terrible that our iron ores, gold, silver, copper, and diamonds exist as gases there. The rays of this heat travel at the rate of 11,600,000 miles a minute and reach us in eight minutes. Such speed is inconceivable. The swiftest cannon-ball is motionless compared with such rapidity of motion. There are storms on the sun compared with which our Galveston hurricanes and Mont Pelée eruptions are like the breathing of an infant. Are the storms periodic? Do they follow some sequence, some law?

The sun is much brighter and hotter at certain periods than it is at others. According to Professor S. P. Langley, during 1904 there was a notable decrease in the amount of heat received from the sun. The same report came from Italy. Why the sun was so stingy we do not know; whether its generosity is periodic or incidental is a riddle to us. If we did understand its moods and their reaction upon us, we could predict the weather for a season in advance. Now, the sun is the creator of all life, of all force and motion on the earth except the tides. Every act of it is so orderly and systematic that we must believe that the processes going on within it are also systematic; that the changes we think we see in it follow each other in regular succession, as our spring follows winter, but probably at much longer intervals. Solve the order of the changes on the sun, and we can predict the character of the seasons.

Strange as it may seem, the sun has rarely been studied in its relation to weather. As a rule, astronomers have paid little attention to the weather, while meteorologists know little about the sun.

Realizing that the further development of our knowledge of storms and of weather generally depends in large measure upon a better understanding of the sun and its relation to the meteorology of the earth, Congress recently, on the recommendation of Secretary Wilson, gave the Weather Bureau a sum of money to found a meteorological solar observatory. The constant procession of storms that sweep across the United States makes our country a particularly good place to study the relation of sun and weather. The site chosen was an unnamed peak in the Blue Ridge, sixty-five miles from the national capital. The



From photographs

Freaks of Tornadoes

A spade driven into a tree—Straws driven into trees—A splinter driven into a log

Weather Chief christened the peak by the fitting name of Mount Weather. Substantial buildings are being erected there, equipped with telescopes, magnetic instruments, bolometers, and every appliance man's brain has yet devised to catch the secrets of the sun, and here the meteorologists will study the sun and try to find out how it governs our rain and sunshine. Speculators in wheat and cotton may find it to their profit to watch the observations of the Mount Weather Observatory and thus perhaps anticipate dollar wheat and sixteen-cent or six-cent cotton months ahead of the market.

The plan of the Mount Weather Observatory is probably the most important ever undertaken for the advancement of meteorological science. The sun holds the key to the weather. The Weather Bureau will search for this key, and with it, we hope, unlock the mysteries of cyclones, of droughts, and of torrential floods, and thus foretell the years of plenty and of famine.

THE WORK IN THE PACIFIC OCEAN OF THE MAGNETIC SURVEY YACHT "GALILEE"*

By L. A. Bauer

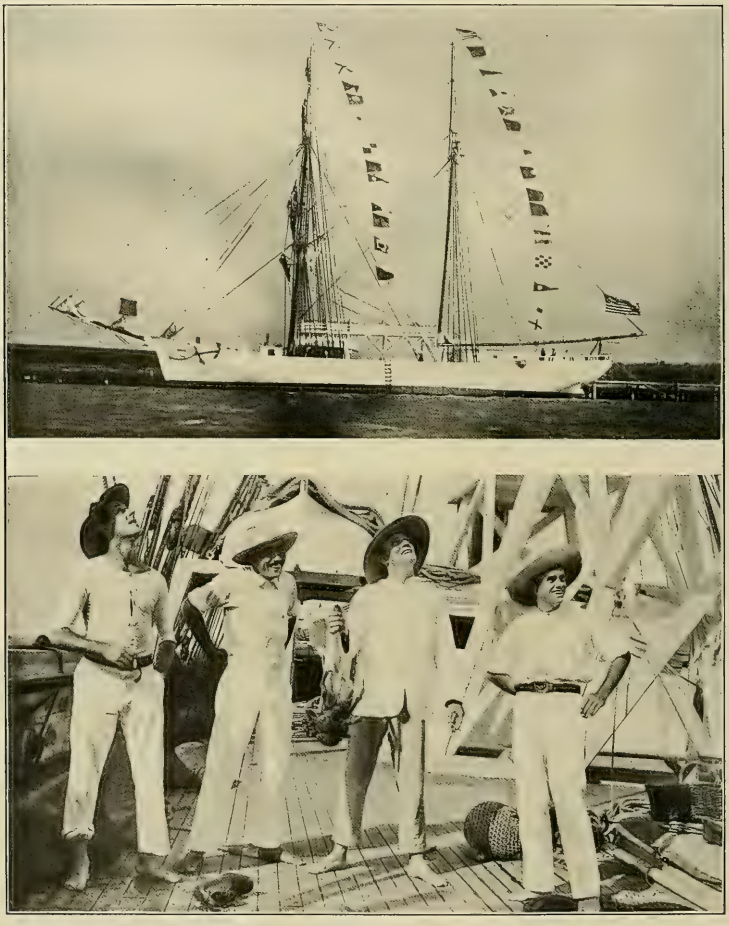
Director, Department Terrestrial Magnetism, Carnegie Institution

In 1905 the Department of Research in Terrestrial Magnetism of the Carnegie Institution of Washington was authorized to undertake a magnetic survey of the North Pacific Ocean, in accordance with a plan submitted by Messrs L. A. Bauer and G. W. Littlehales, and the necessary funds were allotted.

Captain Creak, for many years Superintendent of the Compass Department of the British Admiralty, now retired, said some years ago: "The North Pacific Ocean is, with the exception to the voyage of the *Challenger,* nearly a blank as regards magnetic observations." Various eminent authorities in terrestrial magnetism have expressed their opinion that no material progress can be hoped for in the unraveling of many of the vexing questions that confront us in this most elusive and enigmatical field of research until we possess complete magnetic surveys of the oceanic areas as well as of the land areas. The area of the ocean exceeds that of the land by nearly three times, and, in conformity with general experience, magnetic observations made on oceanic islands or along the coasts are almost invariably more or less affected by local disturbing influences. It may therefore easily happen that some of our present ocean charts of the lines of equal magnetic variation, used by the mariner to guide him over the trackless seas, do not possess the accuracy required for even purely *commercial* purposes.

The reasons which actuated the authorities of the Carnegie Institution in undertaking the magnetic survey of the oceans and unexplored regions to satisfy both commercial and scientific requirements are thus made patent. Captain Creak's remark also shows why the beginning was made in the ocean so rapidly developing just now in commercial importance—the North Pacific Ocean. Here the mariners' charts of the compass direction have had to be based, until a few months ago, upon but a very small number of observations of the requisite completeness and accuracy.

* An address before the Washington Society of Engineers, May 21, 1907.



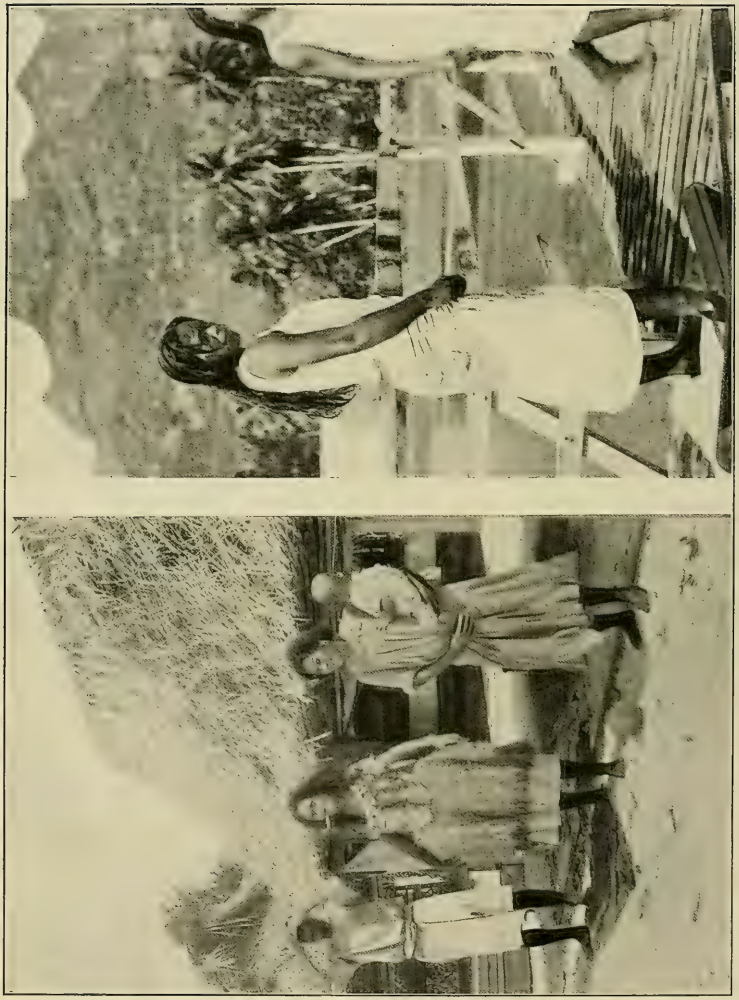
The Yacht *Galilee* at San Diego Dressed in Honor of Washington's Birthday

Scene on Board the *Galilee* while Working near the Equator

Inhabitants of Fanning Island

A Scene on Nukahiva, Marquesas Islands

These and following illustrations are from photographs taken by members of the staff of the *Galilee* during the survey of the Pacific Ocean, and sent to this Magazine through the courtesy of Dr L. A. Bauer.



Natives of Fanning Island

Women of the Marquesas Islands

The Carnegie Institution work of the past two years has already yielded sufficient results to enable the United States Hydrographic Office, with the aid of these newly acquired data, to issue recently a new chart of the "Lines of Equal Magnetic Variation."

It was found that in the North Pacific Ocean previous charts were out 1° to 3°—amounts of sufficient importance to safe and rapid navigation, especially as it was found that the error was systematic over large areas. For example, in the region between San Francisco and Honolulu recent charts gave systematically too small a value of easterly variation (magnetic declination), so that the compass actually pointed 1° to 2° farther east than shown by the charts used in directing the course of a vessel between these ports. Since the distance is about 2,000 miles, and assuming an average systematic error of but 1°, it might transpire during a cloudy or foggy passage, when no sun or stars would be visible and sole dependence would have to be put upon the compass and the log, that the vessel at the end of her 2,000-mile voyage would find herself too far north by about 1/60 of the distance traversed (roughly, 35 miles)—sufficient to prevent a successful landfall!

It requires three sets of lines to completely map out the earth's magnetic lines of force:

1st. The Chart of the "Lines of Equal Magnetic Declination," or, as the mariner calls them, "Lines of Equal Magnetic Variation." These lines connect the places where the compass points the same amount; for example, 5° east or west of north, as the case may be. This chart is the one of prime importance to the mariner or to the surveyor who must rely upon the compass. Unfortunately but a comparatively few years suffice, on account of the progressive changes occurring in the earth's magnetism, to considerably destroy the value of such a chart. In certain parts—*e. g.*, in the vicinity of Rio Janeiro—six years are sufficient to produce a change of 1° in the compass direction; on the average, over the earth it requires about 20 years to produce an alteration of 1°. Hence it is necessary to reoccupy or repeat the magnetic observations at a sufficient number of points over the globe to keep "tab," so to speak, on these changes and thus keep magnetic charts up to date.

However, in terrestrial magnetism the stage of determinism has not yet been reached as it has in astronomy. Eclipses and other astronomical events can be predicted many years in advance with unerring precision. Though knowing the *precise* state of the earth's magnetism at any given time, it is not yet possible to predict what it will be but a comparatively short time later, with sufficient accuracy and in every locality, for even the purely *practical* purposes of life, to say nothing of purely scientific demands. While it may be that the problem of magnetic predictions is a far more difficult one than that of astronomic events, it certainly does not appear as complicated as that of long-range weather forecasts. I believe that the prime reason for the backward stage in terrestrial magnetism is to be ascribed to the general lack of means hitherto available for the accumulation of the necessary data. We are but *beginning* to appreciate that the physical phenomena of the earth demand equal attention with the study of celestial phenomena, and that the solution of some of the vexing questions pertaining to the physics of the earth undoubtedly will be accompanied with results of the highest importance not only to science but to man as well.

Next, it is necessary for a complete delineation of the earth's magnetic forces to construct the "Chart of Lines of Equal Magnetic Dip" and the "Chart of Lines of Equal Magnetic Force." These two charts, as far as the mariner's purposes are concerned, do not require to be quite as accurate as that of the "Lines of Equal Magnetic Variation," since they are used only in determining how much a compass, disturbed by the iron in a modern vessel, must be corrected. However,

Native Women Playing Cricket at Pago Pago, Samoan Islands

Natives Bathing at Pago Pago

Fiti Fiti Guard, Samoan Islands

science requires an accurate set of these latter charts as well as of the first one, if any progress is to be made in the solution of some of the questions above raised. You will therefore be interested to know that the work of the Carnegie Institution has already shown that the values of dip given by the latest charts were found to be out from 1° to 3° and more, being in general too small, and that the chart values of horizontal magnetic force were in general too high by about 1/25th part.

So much for a brief statement of the general results already achieved; now a few words as to the vessel, personnel, methods employed, and the cruises.

After considerable advertisement, we chartered the brig *Galilee,* a wooden sailing vessel built by Matthew Turner, of California, in 1891 and engaged in freighting in the Pacific Ocean. Her length is 132.4 feet; breadth, 33.4 feet; depth, 12.6 feet, and her displacement about 600 tons. She has the record of being one of the fastest sailing vessels of her size in the Pacific Ocean. Besides the scientific party, consisting at present of Mr W. J. Peters, commander of the expedition; Messrs J. C. Pearson and D. C. Sowers, magnetic observers, and Dr George Peterson, surgeon and recorder, the *Galilee* carries a crew of ten men and sailing master, Captain J. T. Hayes. (Members of the National Geographic Society will recall that Mr Peters, the energetic commander of the *Galilee,* was their representative on the Ziegler Polar Expedition of 1903–'05 as second in command and in charge of the scientific work.)

Through the courtesy of the Secretary of Commerce and Labor the *Galilee* has been classified as a yacht, thus greatly facilitating her passages between foreign and domestic ports, as far as compliance with the usual custom-house formalities are concerned.

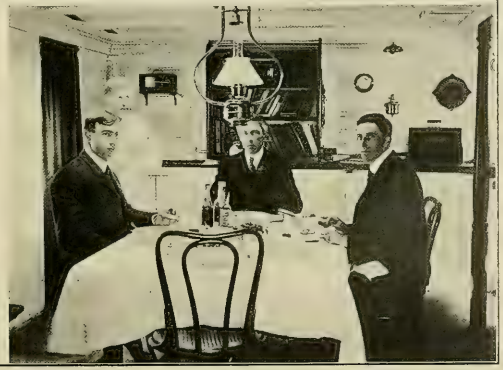
The principal changes required to adapt the chosen vessel to the work undertaken were the substitution of the steel rigging by hemp, the replacing as far

Photo from "Le Tour du Monde" (Paris)

A Fiji Islander

Scene in the Fiji Islands

Photo from "Le Tour du Monde" (Paris)



The observers en route to the observing station near Yokohama.

View of the special observing bridge, showing the observers and the four instruments used (from left to right, Lord Kelvin Dry Compass, Negus Liquid Compass with Horizontal Deflector, Ritchie Standard U. S. Navy Liquid Compass with Azimuth Circle, and L. C. Dip Circle). Each magnetic element is determined in two totally different ways by different observers and at different parts of the bridge.

On August 24, 1906, the *Galilee*, not having any auxiliary power, was blown on the breakwater at Yokohama by a typhoon and such damage sustained that she had to be dry-docked for the necessary repairs. Fortunately the damage was not very serious.

View of the scientific party taken in the cabin of the *Galilee* by J. C. Pearson, magnetic observer. The leader of the expedition, Mr W. J. Peters, is in the center.

as possible of the iron in the blocks and tackle by non-magnetic metal, and the building of a special observing bridge, running fore and aft between the masts and placed about 15 feet above the deck. The instruments mounted on this bridge were, on the average, about 25 to 30 feet from the remaining masses of iron, consisting chiefly of the iron bolts in the sides of the vessel.

While, then, it was not possible to convert the *Galilee* completely into a non-magnetic vessel, as would have been desirable, the changes made resulted in reducing the corrections due to the disturbing influences of the iron to such an extent that the so-called "ship's magnetic constants" turned out to be smaller for this vessel, on the average, than those of any vessel thus far engaged in oceanic magnetic work.

However, the corrections are still large enough so that they require to be taken into account to satisfy the requirements of the work. These corrections must be determined by special observations, consisting of swinging ship in port and at sea as often as circumstances will permit, which necessarily cause more or less delay in both the field and office work. Unfortunately, experience during the past two years has also repeatedly shown that these corrections do not strictly follow the physical laws prescribed by the analysis of the deviations, namely, the corrections arise chiefly from the magnetic induction in the soft-iron parts of the vessel, and hence are subject to various accidental conditions, such as length of time pursued by the vessel along any one course or the amount of buffeting the vessel has been exposed to from the waves, etc.

It would be more economical all around were it possible to secure an entirely non-magnetic specially built vessel. The construction of such a vessel presents no mechanically unsurmountable difficulties. It seems a pity that in the very regions where the disturbances due to local magnetic masses are a minimum we should introduce an extraneous source of disturbance by not having an entirely non-magnetic vessel.

It is hoped that the necessary funds—about $75,000—may soon be secured for the construction of a vessel suited to the importance of the work undertaken. The new vessel would be again a wooden sailing vessel, built somewhat along the same lines as the one at present employed, except that no material whatsoever having a magnetic influence would be used. This would mean the exclusion of all iron and steel except such as would come at a distance far enough away as not to affect the magnetic instruments.

An all-sailing vessel, however, does not permit the magnetic survey to be undertaken with the completeness and success demanded, since with such a vessel it is more or less dangerous to investigate the magnetic irregularities almost invariably shown to exist near land masses. The mapping of these irregularities is of the greatest importance to the mariner, as in many cases they are sufficient, if not allowed for, to land a vessel on the rocks. For such close shore-work it is essential that the surveying vessel be provided with some auxiliary motive power in addition to that derived from the sails. This auxiliary power would be supplied by a gas or gasoline engine, in which but a very small amount of steel is required, the engine being furthermore at such a distance from the instruments as not to have an effect.

Besides greatly facilitating the acquirement of the magnetic data and reducing the running expenses, the new vessel would materially add to the safety and comfort of those on board who are devoting their lives to such arduous work. Let us therefore hope that the day is not distant when the magnetic survey of the oceans can be undertaken with the completeness, the expedition, and safety that its importance demands!

HUNTING THE GRIZZLY IN BRITISH COLUMBIA

By Joseph Wendle

HUNTING the grizzly in its natural wilds may be termed an exhilarating pastime, but before the bear is finally captured many things are apt to occur which make the oldest and most experienced hunter put forth his best efforts. To the observer it may seem as easy to kill a score of bears as so many deer, but when you happen across a grizzly that has never been compelled to leave its own trail, it is advisable to think twice and then feel your pulse.

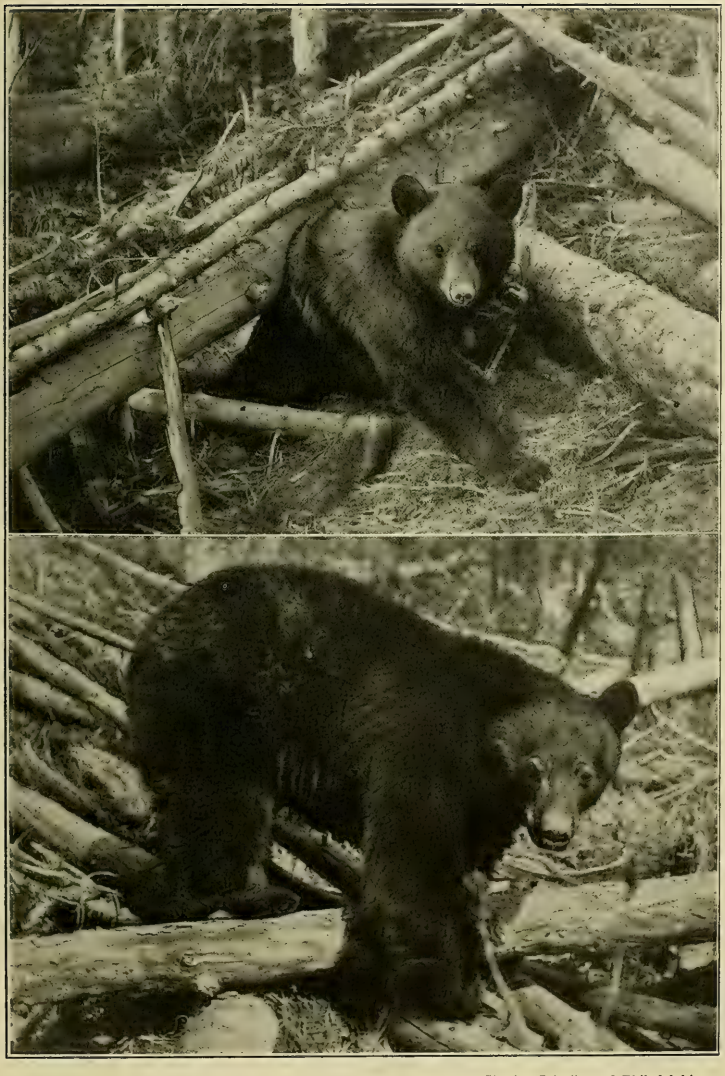
On approaching the feeding grounds of the grizzly, much care must be taken by the hunter. If the game is disturbed quietly, it will give you the slip and get away; but if you come in contact with it suddenly, at short range, you may get into serious trouble.

When on a hunting trip not long ago and passing through an unexplored section, we suddenly came across three grizzly cubs. Being to windward, we managed to get quite near, and while watching and admiring, without a thought of hurting them, we were suddenly charged by their mother, and, not having guns for such large game with us at the time, we were forced to run, and were chased into a small lake near by, the close proximity of which doubtless saved us. In this stampede my position by accident was in the rear. With the bear thundering along with its mouth wide open, at times running in an upright position and only a few feet behind, I certainly felt that I would be knocked into the "great beyond" at every step, so close behind me came her bearship.

At one time, while camping in a high pass, a large grizzly could be seen about two miles away and up a steep mountain side. After a short discussion, it fell to my lot to supply the camp with fresh meat.

It was late in the evening, and I had to hurry to get within shot of the game before dark. After much hard climbing I reached the spot, only to find my bear had gone. Resting for some minutes after the climb, I heard a disturbance below me and immediately saw the bear following my tracks up the steep mountain side. Being above the timber-line and in a rocky spot, all seemed easy; and as the bear came within shooting range, he grew larger and larger, until it looked like an impossibility to miss him. My first shot took him by surprise, and with loud roars of rage he rolled over and over; but in an instant he was standing upright again and started up the hill so rapidly that I realized things were getting serious. With an angry grizzly closing up fast and an exploded shell jammed in the breech of my rifle, I had to think quickly, and instantly made up my mind to take my chances on a passage down a snowslide almost at my feet on the steep incline. Once having started, there was no stopping, and I made the fastest trip of my life, had the good fortune to land safely, and reached camp in a few minutes, being very glad to be alive. For the following few months I felt I had lost no bear.

On one occasion while on horseback I came across a grizzly while he was feeding on the carcass of a young deer he had pulled down, and as he made no attempt to get away I had little trouble in getting a shot. The ball carried away a considerable portion of his face, and his roars caused my horse to take fright and run away. My dogs in the meantime took up the fight and drove the bear back into the thicket, and when I finally got the horse under control the bear had departed. Shortly after this I again came across him, just at dusk, and after firing several shots he again disappeared in the



Photos from Mrs Charles Schaffer, of Philadelphia

A Grizzly Caught by a Fallen Log—a Cruel Trap

A Black Bear Trapped

Two Grizzly Bears Shot by Joseph Wendle, of British Columbia

thicket. The next morning, nearly a mile from the spot, I found him dead, and discovered that one of the bullets had passed horizontally through the largest diameter of his heart.

On following a bear trail into a thicket on another occasion, I found that to continue I must crawl on my hands and knees, and as I passed under fallen trees and undergrowth the daylight was turned into darkness. I came upon a swampy piece of ground, and as all seemed quiet I let my dog follow the trail. He made a considerable disturbance ahead of me, while the bear, who had taken fright, was trying to get away, slightly on my right. Being in no position to shoot, for the longest unobstructed range could have only been ten or fifteen feet, and seeing by the disturbed bushes that everything seemed to be coming my way, I lost no time in getting up a tree well above the ground, and while I was still scrambling to gain my equilibrium, the game passed below and went on.

I have been told by responsible parties of many lives that have been lost hunting grizzlies and know personally of two cases of men who never returned from bear hunts, and later remnants of clothes and pieces of their skeletons were found. In one instance the searching party, as it approached the spot where the fight took place, were attacked by a large grizzly, who managed to get away.

In the photograph are two grizzlies killed by myself and friend.

SCENES FROM NORTH AFRICA

THE renewed disturbances in Morocco lend special interest to the illustrations from North Africa contributed to this number of the NATIONAL GEOGRAPHIC MAGAZINE by Mr David Fairchild. Morocco and Abyssinia are the only countries of Africa that have not yet been subjugated or politically annexed by a European power. Morocco has a population of from 4,000,000 to 15,000,000, or whom two-thirds are Berbers or of Berber descent. These Berbers are the aborigines. They are a purely white race, and Mr Ion Perdicaris has described them (NAT. GEOG. MAG., 1906, p. 118) as a very energetic and vigorous people. They antedated Phœnician, Carthaginian, Roman, Gothic, Byzantine, and Arab occupation by centuries and form one of the oldest living races and there are certain ethnologists of the present day, at the head of whom is an Italian writer named Sergi, who maintain that the theory of the successive invasions of Caucasians, which are generally believed to account for the origin of the races of southern Europe, did not furnish the main part of the population of the Mediterranean basin, but that the latter was derived from these Berbers, a white race which has many resemblances to the ancient Etruscans. They are also quite like the pictures of some of the ancient Egyptian dynasties.

The Berbers have always opposed any attempt to control them, and have never been held in subjection for any great length of time. They dislike any more authoritative rule than that of their own village elders.

There are two other important factors among the population—the Jews and the negroes. The Jews are mostly exiles from Spain and Portugal, having been driven out after the Moors had been expelled from Spain. The Jews were driven out by the Inquisition, and a great many of them came over to Morocco and settled there. Others went as far east as Turkey. Still others visited other countries. Those who settled in Morocco were almost all confined to a special quarter of the towns, entitled El Mellah. This word Mellah means salt, and it comes from a very curicus feature in the customs of the country. Whenever rebellions break out—and they are very frequent occurrences—the soldiers in Morocco have instructions to bring in as many heads as possible. These heads have to be preserved and salted, and nobody likes to execute this commission; consequently the Jews were compelled to undertake this revolting task.

Photo from David Fairchild, U. S. Dep't of Agriculture

Moorish Girl, Tangier, Morocco

Photo from David Fairchild, U. S. Dep't of Agriculture

Moorish Girl, Tangier, Morocco

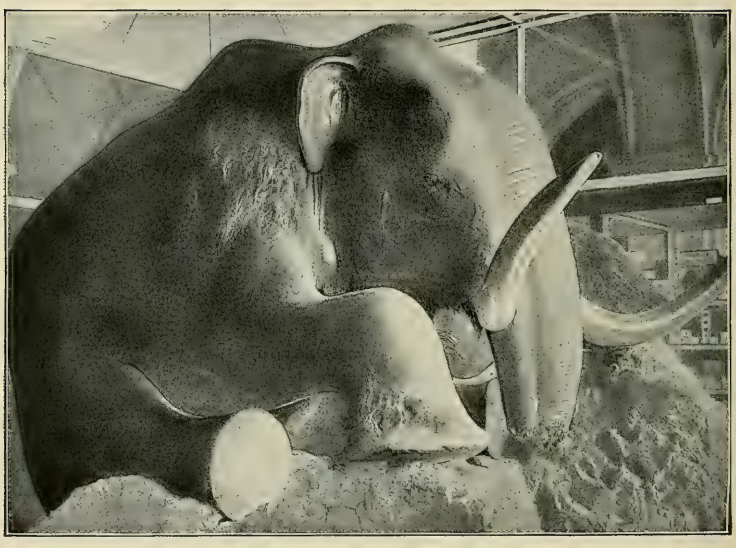
Photo from David Fairchild, U. S. Dep't of Agriculture

In the Sahara Desert

Photo from David Fairchild, U. S. Dep't of Agriculture

Jewish Girls of Tunis

The Jewish girls of Tunis eat the seeds of the fenugreek, a leguminous plant, to make them fat. No young Jew of that region would think of marrying a girl until she had increased her weight to the fashionable figure of 250 or 300 pounds



Mammoth Recovered from Northern Siberia

A STRANGE AND REMARKABLE BEAST

THE mammoth shown in the accompanying illustration had been preserved in the frozen soil of the tundra of Siberia so perfectly that after countless centuries the flesh and hair appeared almost as fresh as if the animal had been dead only a few hours. The average size of the mammoth appears to have been about the same as that of the existing species of elephants, but nature had provided it with a dense clothing of long, coarse, outer hair and close, under, woolly hair of a reddish brown color, in order that it might be equipped for the cold climate of its habitat.

The geographical range of the mammoth was very extensive. There is scarcely a county in England in which some of its remains have not been found, either in alluvial deposits of gravel or in caverns. Its remains have been found throughout central Europe, northern Asia, and the northern part of the American continent, though the exact distribution of the animal in the new world is still undetermined. The mammoth belongs to the post-Tertiary or Pleistocene epoch of geologists, and was undoubtedly contemporaneous with man in many places. It probably existed in Britain before, during, and after the Glacial period.

Many remains of this huge beast have been found in Siberia, and it is stated that for a very long period there has been a regular export of mammoth ivory from that region for commercial purposes. Nordenskiold, who had special opportunities for studying the subject of the mammoth during his northeast passage, states that more than 100 pairs of mammoth tusks have come into the market yearly during the last 200 years. The Siberian shore between the mouth of the Obi River and Bering Strait and the Arctic islands to the north were reported by him to contain the relics of many thousands of mammoths.

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE CHINESE JEWS

By Oliver Bainbridge

THE Chinese history affirms the city of Kaifengfu to have been the metropolis of the province and the seat of the empire during a long succession of monarchs, till it was at length overflowed and covered with sand by a great inundation. It is situated in a large fertile plain, about 5 or 6 miles from the Yellow River, and its low situation occasioned its ruin in 1642, when it was closely besieged by the rebel Li-Chung, at the head of 100,000 men. The general who was sent to relieve it conceived the fatal design of drowning the besieging army by breaking the great bank which had been reared at a vast cost to preserve the country from being overflowed by the Great Yellow River. His project succeeded, indeed, but proved the ruin and destruction, not only of the noble capital, but of three hundred thousand of its inhabitants, by the violence and rapidity of the inundation.

Some fifty years after this dreadful catastrophe a Jesuit missionary, going upon some occasion into the province of Honan, found a considerable synagogue in the city of Kaifengfu. He soon became acquainted with some of its learned chiefs, who introduced him into their synagogue and showed him one of the parchments or rolls of the Pentateuch written in Hebrew, together with the books of Joshua, Judges, Samuel, Kings, some of the prophets, and others containing their liturgy and commentaries. They owned they had lost some of the sacred books and some of their targums or paraphrases. This loss was caused by a violent overflowing of the great river, which had laid the capital wholly under the water and had damaged their Torah, or roll of the Pentateuch, and upon which they ordered twelve new copies to be taken from it. Today I find no synagogue, owing to another overflowing of the Yellow River—"China's Sorrow"—but in its place a dirty pond and a stone erected on the site bearing the following strange inscription:

"A monument in memory of the Great Ching Ching Cenoby. Oh Wu Lo Hau, the creator of this religion and grandson of the nineteenth generation of Punku, the principal ruler of the Mythical Era, was born in 146th year of the Chow dynasty (976 B. C.). He proved himself to be very wise, prudent, and merciful. He understood the mysteries of creation and the ideas of creation and could trace the troubled source of religion. The religious elements were not to believe in any idolatrous representation and not to flatter the ghost and fairy, and so

many people were at liberty to serve his religion as Cenobites in a manner that was as free as running water. The successor of Oh Wu Lo Hau was called La, and was born in the 613th year of Chow dynasty. His conscience and benevolence were noted by every one as he traveled to the Lah-na Mountains for the purpose of informing them regarding the Scripture. He restricted himself to fruits and vegetables instead of meat and bathed and fasted for forty days and nights. He attended to his duty with the utmost simplicity and sometimes even forgot to eat or sleep, but never ceased to pray with a sincere heart to his God, for he had obtained a book containing many sections. In this book there were strange things that could not be easily explained—in short, it indicated that the good was affected by those who became good, and the evil by those who did not bear in mind the warning. The successor of La was called Lo Tze Loh, and received from his predecessor the proper doctrine and explained the four words—"ching" (clear), "chew" (pure), "li" (ceremonial), and "pai" (to worship with a bow.) The word "ching" means to "direct your heart singly to one religion." The word "chew" means "not to be confused by any other secular ideas." The word "li" means "to stand on ceremony," and the word "pai," "to worship with a bow." With these instructions, the Cenobites were to teach one another in future.

During the beginning of the Sung dynasty (96 A. D.) there was a missionary surnamed "Li," who was accompanied by a crowd of Cenobites, and arrived in China with a lot of western cloth, which they presented to the Emperor of the Sung dynasty and became citizens of the country. Subsequently one of the grandsons of these people, called "Mu Sy Ta Pan," was appointed to do the preaching, and another, called "Jen Tu La," began to build a cenoby. It was destroyed after that and had to be rebuilt at the southeast of Tu Chai, in the 16th year of the Yuen dynasty (1280 A. D.).

The Emperor Tai-Tsu, of the Ming dynasty (1368 A. D.), gave the Cenobites descended from Li a piece of land for their building, because he could well understand their Scriptures, which persuaded the people to do good instead of evil."

In the 19th year of "Wung Lo" (1403 A. D.) the cenoby was rebuilt, and was long afterwards destroyed by water, and the ruined scene that exists now proves this little bit of narrative.

The vast community referred to in the inscription has dwindled down to 8 families, numbering in all about fifty persons, who have in a great measure forgotten their characteristic observances through frequent vicissitudes and varied conditions of life.

I reached the main gate of the city of Kaifengfu (the ancient capital of the Middle Kingdom) one night about ten-thirty, with not too favorable an impression of Chinese carts or the shaggy little Chinese pony, which had a great habit of tearing off at every opportunity. The soldiers belabored the massive gate most industriously for about twenty minutes, when a small trap-door opened and the gate-keeper hurled epithets at us that were volcanic and picturesque. But when his saffron-colored palm had been covered with a few coins, his ruffled nature became as smooth as a sheet of polished silver, and we entered the ancient capital of the Middle Kingdom. For two miles we had to pick our way through narrow, stinking, slushy streets, packed with men, boys, horses, goats, sheep, dogs, cats, and donkeys, sleeping all over the place, while the changing of the night watchman's irons and the piercing wail of ragged, starving, filthy beggars carried one for the moment to the land of "ten thousand curses." What an unspeakable joy to reach the residence of Mr. C. W. Shields, the district inspector of Chinese posts, who received me with the courtesy of a prince. We had scarcely spoken a dozen words when the magistrate's secretary called for my card.

Next morning, before I was out of bed,

Memorial Stone Discovered by Mr Bainbridge Referring to "Foreign Heaven Chapel"

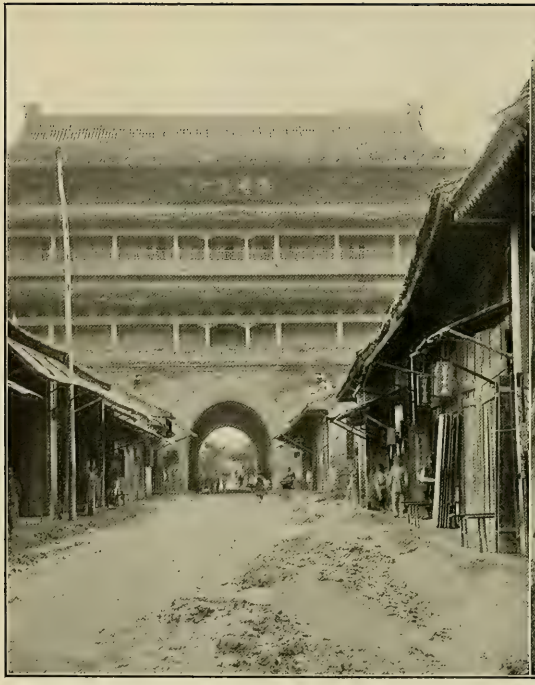


Photo by O. Bainbridge

The Main Gate of the Chinese City of Kaifengfu

Photo by Inspector Shields

Kiosh Imperial Palace, N. L. Chang, Shu Shen, and Mr Bainbridge

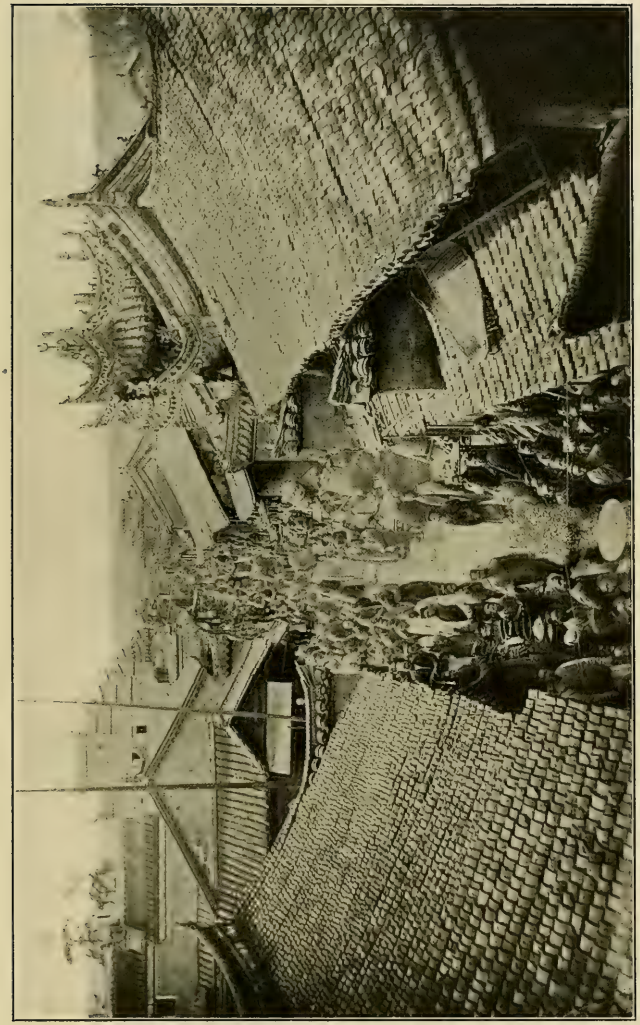


Photo by O. Bainbridge

Chinese Waiting to See Mr Bainbridge Pass Along the Street

Photo by O. Bainbridge

Chinese Jew Who Told Mr Bainbridge the Wonderful Story of His People

another dignitary wanted to copy my passport, and informed me that it would be well to call at the Foreign Office. This I did, and found the officials polite and much interested in the object of my visit to their city, particularly His Excellency Chang Shu Shen, with whom I paid a visit to the imperial palace, one of the greatest curiosities in the whole empire and situated in the very heart of the city—a prodigious group of edifices, vast courts, gardens, kiosks, and palms, surrounded with a stately wall of considerable compass. It contains all the spacious and stately apartments of the Emperor and his family and afforded a safe retreat for the Dowager Empress during the occupation of Peking by the foreign troops. The city gates, pagodas, arches, towers, castles, banks, and other public buildings display a magnificence that must have been truly grand prior to the sad havoc wrought by the flooding of the Yellow River. A number of new, ricketty-looking pieces of printed yellow and vermilion rice paper, pasted on the doors of every house and shop, I discovered were prayers against the evil influences of the foreign devil that had just arrived, and it was with considerable difficulty that I managed to get through the tremendous crowds, gathered in the streets to hear the foreign devil speak and curse him as he passed.

During the first three days I located all the temples and mosques likely to afford me any data, and on the fourth morning visited the ruinous site, which gave no evidence of the magnificent synagogue that once stood there or the wealth of its community, save for a weather-beaten commemorative stone that told the story of these people. While I was photographing and rubbing this stone, thousands of Chinese gathered around, and they came to the erroneous conclusion that I was a Jewish rabbi come to succor Chinese Jews, which the Mohammedan portion did not particularly relish, owing to the fact that a great many of the Jewish community had merged into Mohammedanism through persecution and distress. The Chinese always referred to the Jews as the "sect which pulls the sinews" and as the "Mohammedans with blue bonnets," because they wear blue bonnets as well as take off their shoes during all religious ceremonies.

One handsome, intelligent Chinese Jew came forward and introduced himself, inquiring very diligently the reason of my taking the photograph and rubbing of the stone that spoke of the grandeur of his ancestors and their synagogue. I told him that I wished to inform the Westerners, who feel the deepest interest in the Jews, because our Christian religion has come from a Semitic race. The long line of noble men to whom the Jewish nation has given birth, from the time of its founder, Abraham, and the fearless testimony which since the days of captivity it has borne to the lofty truth that there is one God, and none other, must ever give to the scattered people a large place in our veneration and love. Only it must be no blind, but a pure and true, veneration, born of a careful study of all they have been and all they have done. I persuaded him to come to the house, and he unfolded the following remarkable story:

"My elder brother—I am not yet forty years old, but I have thought and talked much with my friends about our ancestors, who were rich and numerous and who worshiped in a fine synagogue, built on the land presented to them by the Emperor Tai-tsu. This synagogue, you know, has been swept away by 'China's Sorrow' [the Yellow River]. Our ancestors came to this land from the northwest nearly three thousand years ago, and had with them a roll of the law that was very ancient and in a language that we do not understand today, because we have no teachers. The beautiful synagogue had a number of courts, and in the center of the first there was a large, noble arch, dedicated to the Creator, Preserver, and Father of all men. The second comprised sacred trees, and the houses of the good men who cared for the buildings. The third had many trees, and on its

walls tablets in memory of our great Chao [a Jewish mandarin judge, who rebuilt the synagogue on one occasion] and other holy men. It was very large and contained the Hall of Ancestors, the brazen vases of flowers and the censors, in honor of Abraham and others. The nerves and sinews were extracted from animals slain for food in this court.

"The synagogue itself was small, but exceedingly beautiful, and in the center was the throne of Moses, a wonderfully carved chair, covered with embroidered silk, upon which they placed the sacred book while it was read. Above the throne, in letters of gold, were wise and good words our ancestors brought from afar: 'Hear, O Israel: The Lord our God is one God, Blessed be the name of the Glory of his Kingodm forever and ever,' and in another part of the synagogue, 'Blessed be the Lord forever; the Lord is God of gods and the Lord; a great God, strong and terrible.' Near the arch on which these last words were written our ancestors always washed their hands except the chief [rabbi], who entered the 'House of Heaven' [a little square room, which none but the rabbi can enter during the time of prayer]. In the 'House of Heaven' the rolls of the law were kept in silken curtains, and on the western wall the Ten Commandments were written in large golden letters.

"Our ancestors suffered many hardships, for the Chinese officials objected, and with force, to their slaughtering animals for themselves. Even today they object to our circumcision, which they denounce as a barbarous and cruel practice. Our lot is truly sad, thrown as we are amidst enemies, unsupported and slowly overwhelmed by our surroundings. We are a pitiful remnant of the past, and there seems to be no morrow for us—the dawn is dark with tears."

I asked him if they had any scrolls today, but learned that the majority had been destroyed at different times; but they did manage to preserve two, one of which they sold to a missionary because they were starving, and the other was blown to heaven in the following manner: One day a foreigner visited this city and asked to see the sacred scroll; but when they opened the ark they found it quite damp and laid it upon the grass to dry. A wind came, and it disappeared into the unknown. The probability is that the foreigner by some trickery secured the scroll, and led them to believe that the wind had carried it off. Early in the following morning eight of the Jews (the whole of the male community) called and gave me much valuable information regarding the Mohammedans and Confucians, who had stolen many things from the Jewish ruins, including the ark of the Sepher Torah, and Jewish tiles bearing sacred inscriptions. This made me desirous of locating and, if possible, securing them. After much difficulty and tipping I persuaded my visitors to be photographed, and then, accompanied by Mr Shields, My Hu (my interpreter), and two soldiers, I visited mosque after mosque, which excited and annoyed the Mohammedans, who mistook me for a Jewish rabbi in disguise.

The fourth proved to be the one I wanted, for in a small room I saw the ark on a table, and made toward it, when the crowd objected and pushed me out, emphasizing their disapproval in no uncertain manner. The soldiers were helpless, but I had a strong suspicion that they were at heart with the mob. The climax came when I clambered on the roof of the mosque and began to examine the tiles, for thousands of Chinese surrounded the mosque, yelling out, "Kick the devil's stomach!" "Batter his devil's brain on the stones!" "Kill the Jew!" "Choke the sinew-puller!" "Tear the foreign devil's entrails out!" and other diabolical things too numerous and too disgusting to mention. The majority were armed with bricks, clubs, or knives and were mad with rage. Every second I thought would be my last, for the fury of the Chinese mob beggars all description.

A happy thought flashed through my

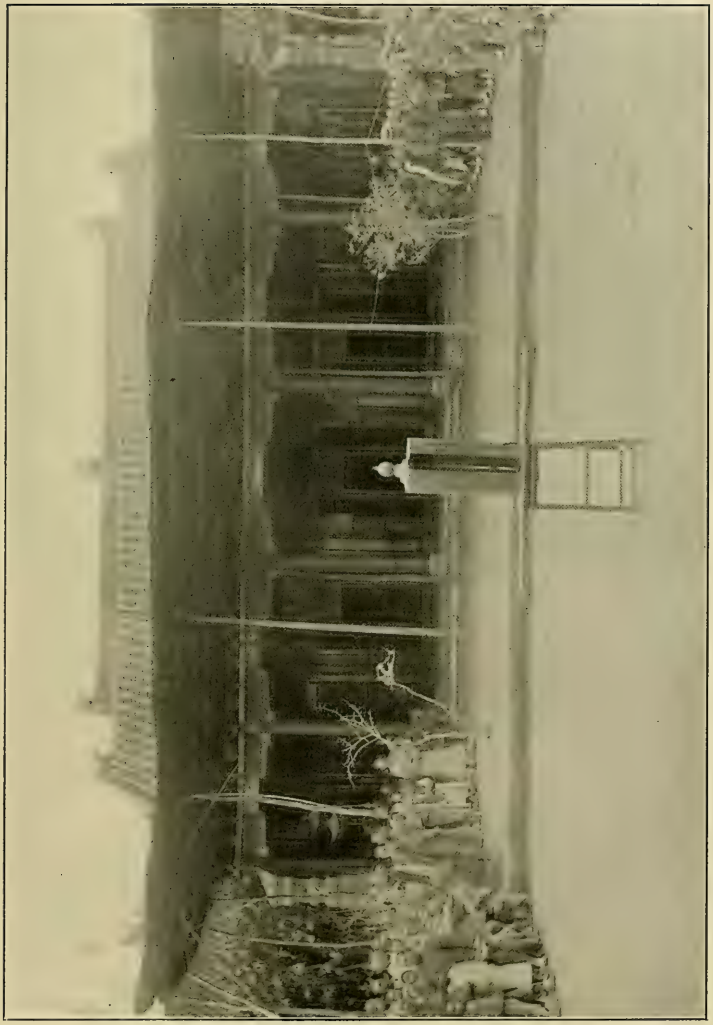


Photo by Inspector Shields

Mohammedan Mosque in which Mr Bainbridge Discovered the Jewish Ark

Photo by O. Bainbridge

District Inspector Shields and the Officer in Charge of the Escort on the Site of the Guafofu

mind and, quick as lightning, I pulled out my folding camera and turned it toward them, thinking to photograph the murderous beasts before they butchered me. The shock was tremendous; they dropped their bricks, knives, and clubs, and crushed and jammed one another in their rush from the "devil's glass." My friend, interpreter, and soldiers very discreetly banged and fastened the doors after them, and the interpreter explained to the Mohammedan priests that I was not a Jew, but a British traveler, and only wanted to see these things. They said if I would promise that in the event of the Jewish synagogue being rebuilt their mosque would not be interfered with, the people would be pacified and permit me to see the ark and examine the tiles. They are much afraid their mosque will be destroyed if the synagogue is rebuilt, in order to get tiles which they have stolen. I promised everything they asked.

The ark (an old cylindrical case) is purely Jewish, but the missing scroll they informed me could not be seen, for it was in a secret place. That evening, about eight o'clock, four boxes of sweets, cakes, and two baskets of tea were sent to me by the priests, with the kind greetings of the people, who had decided to present their "elder brother" with the ark, which they did the next morning. When the Chinese make a present they expect something equally valuable in return, so I sent a few dollars to each priest, which proved to be a lucky move, for I experienced no more trouble during my stay.

The Confucians are more kindly disposed toward the Jews than the Mohammedans (who always pull their gowns to one side if they meet a Jew, which in China is a vile insult); and so on visiting their temples I had no difficulty—in fact, one priest accompanied me to a small temple in the southeast corner of the city, where they have what is left of four large marble pillars, taken from the Jewish ruins in the early part of the sixth century. It is interesting to note in Chinese history that at this time the Empress Dowager Ling, attended by the imperial consorts, ladies of the palace, princesses, and others of high degree, ascended a lofty hill and abolished the various corrupt systems of religious worship, excepting that of the foreigner who prayed toward the west.

The broken pillars found in the Confucian temple prove that the synagogue was a place of considerable size and beauty. It did not resemble the great structures of Europe, on which untold wealth has been expended in obtaining the highest architectural art; neither does it remind one of the modesty of the form of supplication. This unique feature, as well as the fact of the chief covering his face with a gauze when reading the laws, points to the antiquity of the hidden tribe, who are but one of the many tentacles torn from the main body of Jerusalem. A short distance from this temple I found an old, long, narrow stone in the side of an empty mud hut, which bore traces of an inscription dealing with a "Foreign heaven chapel," in which the foreigners that "pluck the sinews" fast and weep together. I sent for two of the most intelligent Jews, who were not aware of its existence or location, and I enjoyed their unmistakable surprise.

On the second visit of the Jews to my house I expressed a desire to see their wives and daughters, and learned very promptly that it would be impossible, as the other Chinese women would say "bad things" (the Chinese are undoubtedly the most evil-minded people on earth) and make their lives even harder to bear, but if I wanted to take a photograph (this was suggested with pecuniary anticipations), I might come to an appointed place in a closed cart with a peep-hole, and instruct my interpreter as to how the photograph was to be taken. I embraced the opportunity, and made an appointment for the following day, and secured fine pictures of the Jewish women and children, who had never looked into the devil's glass before. That evening my "elder brother" called again, and one old

man asked me to present a petition (which he handed to me) to the Jews of the West, so that they would fully understand their wretched condition and help them before they are lost in the "everlasting darkness." The moment has arrived for immediate action, not only by the Jews, but by all the Christian bodies; for, when we take into consideration the very significant fact that the whole Christian world is indebted to the Jews for their religion, which is the basis of Christianity, and for the careful preservation of the books of the Old Testament, it would only be a slight recognition of the world's indebtedness to the Jews if this appeal from the center of China receives the consideration it so richly merits.

TIRNOVA, THE CITY OF HANGING GARDENS

By Felix J. Koch

IT was all because of a tourist—a plain, purposeless tourist, who didn't care to travel long stretches at a time, and who I had lured into accompanying me into Bulgaria—that I chanced upon it. We were doing the sites of the Turko-Russian War, just at the time that Port Arthur was hanging fire, and from Plevna the route lay toward Shipka Pass. That is a pretty good trip, judged by Balkan methods of travel, and Friend wanted to break it. The guide book didn't promise much en route, and he "found no opportunity." At last, in a fine-print paragraph of Myer, the Baedecker of southeastern Europe, he "found his opportunity."

"Why can't we overnight at Tirnova?" he pleaded. "Von Moltke calls it the most charming spot in the world. Listen to this"—and he proceeded to read a page or two of descriptives: blue, oriental skies, picturesque costumes, frisking lambs in green meadows, etc. The days were hot, the cars were dusty, the *chef de la gare,* or conductor, an arrant swindler; and, to tell the truth, all Bulgaria is so picturesque one is loth to go through any faster than he must.

I put on an air of condescension, and said I was willing to try Tirnova. So we bought tickets for the town.

At half-past four we were deposited by the Bulgarian State Railway's trans-Rumelian flyer at Tirnova. The sight was not inspiring. Some meadows; some mountain "go-cabs"—such as I have found at home only in the feud belt of Kentucky—and a mother with a baby. The baby's cap was covered with spangles that were picturesque, and so I snapped a picture of her.

But this did not phase us. Over the Balkans, railways purposely avoid the towns. I am told the custom arose from old Turkish times, when cities paid great bonuses to the railway regime to be avoided, in order that rascally soldiers might not be dumped in their midst between trains. Today, however, I am inclined to believe it is the work of local politicians, in order to give the cabbies of their constituency a chance to make a living at the expense of the stranger. A pretty country road wound off, and down it the cabby bore us—down among partly-forested palisades that stretched to yellow cliffs rising up from a pretty, winding river. Far ahead were other cliffs, and on this perched the town—Tirnova the Beautiful—every house a blaze of color; the roofs of red terra-cotta shingling; the walls painted over in washed-out pinks and browns; the eaves and cornices set in relief by heavy beams that are browned to black by age. Yellows and blues marked other homes. We stopped to take in the perspective—a sec-

Scenes in Tirnova

Street Scenes in Tirnova

ond Naples from the sea—for here, too, the homes are three and even five stories high, a most rare architectural form for the Orient.

We rounded the hill, one of the two steep palisades upon which Tirnova stands, and drew up at the Boris, the Waldorf-Astoria of Tirnova. In my journal I set down my first impression of the house as "nice, but primitive." A correspondent takes notes as he goes along, and it is interesting to see how his opinions change with the fleeting hours. We followed the German-speaking host up one of those quaint winding stairs that recall to an American Tom Corwin's home, and secured a room, a chamber with a charming view over the Sorrento of the Balkans.

Then the tourist and I ventured out to "do" Tirnova. From our window we had solved its peculiar topography—the town stood on two sides of a gigantic mountain, into the valley at whose base another mountain jutted, with the remnants of the suburbs. It was from these slopes, then, that the houses rose, narrow and tall, and of every contour, as they stood in tiers, ever higher, along streets that zigzagged and ambled, so that one never quite knew if the destination was the top or the base of the mountain. Consequently houses stood at the upper side of the roadways only, and as one saw the passing burros from below they appeared to be threading the housetops. The illusion was a most distinctive one, reminding us of the grazing donkeys of Iceland, who inhabit the roofs of their masters' cottages. There was another curious feature to these buildings of Tirnova. Usually the Balkins are not overly generous in the matter of windows, and here especially, where the window-panes are of the many-divided varieties abundant in New England a century past, and are set double against the cruel upland winters, the number of windows might be taken as an indicator of the size of the purse. But it matters not, with rich or poor, on that side of the house which faces the beautiful river —and the side is usually the rear—windows are ubiquitous, and to those of us accustomed to the Turkish bazaar, to find windows in the rear wall of a Bulgarian booth comes as a decided surprise. At these windows, and at those beside the street itself, lace curtains, or curtains of a native reed matting, painted in gaudy figures of forms animate, hang, making even quainter the scene.

The great charm of Tirnova, however, lies in its balconies. Every home—and it must be remembered that store and home are synonymous in the nearer East —has a door, very largely of window glass, in the center of the second-story front, opening upon a little balcony, where oleander shrubs in heavy green tubs blossom the summer through. There the lady sits to sew, or to watch her little ones, or to lean down and chat with passing neighbors. At either side of the balcony is a single window, and in rainy weather she retreats to these. Strangely enough, at Tirnova homes of the rich are limited to two stories; it is the poor who inhabit the tenements, the four and five story structures. But to return to the balconies. Many of them, not content with the oleanders, will have an arbor of grapevines stretched over them, so that the Bulgar dame may sit enshrined in a bower of foliage, from which she may pluck at will the juicy pendent bunches, casting the hulls down on the passer on the narrow sidewalk, or oftener in the comparatively broad street below.

But we are picking Tirnova to pieces —analyzing it, and that robs it of the charm of the *ensemble*. We must ramble out of doors, here and there, in and out, in this Nibelungen-land, noting this and that as it comes and goes, to enjoy the whole. Let us follow the street as it may go. At one hand the houses rise dense, owing to the varying heights and forms, and here the gilded cupola of a Bulgar church breaks the monotone. Now we descend the hill, and upper stories overhang, as they do at Nürnberg, but here so close as almost to touch the neighbor's wall, and we walk

in perpetual dusk. We emerge on an open square, pass a landau covered, as is the Balkan custom, with white linen covers inside; continue toward the barracks and to the market-place, a structure of lattices bisected for stalls, and then reach the heart of the city. We look back and catch sight of the roof-gardens. The tenement-dwellers have the second-story balcony, too, but there are no balconies on floors above, and so they must needs take their airing and their week's washing out upon the roof. There, among the shrubbery, people sit, as do our own fashionable New Yorkers thousands of miles to the westward.

The street is growing uneven now, owing to the flagstones loosening, and in places a step runs across the way, and we find its elevation changed considerably. Here there are stores of caps and shoes; there are kavanas, where the Turkish coffee is served in handle-less cups; and there are other shops presenting but two doors, and not a window to the street, and on their doorsteps the "Jew geranium" blossoms, for these folk are inordinate in their love for flowers. Up above, the balconies are growing richer now—the posts with the strands of drying onions are replaced by graceful ironwork, but we are still among the trades people of Tirnova. Here is a bake-shop, one wall almost open to the road, showing the whitewashed earthen oven, and the booth with the round, half-brown loaves of bread. Next store is a money-changer, a most necessary factor of Balkan life, where there is the coin of so many countries ever current. Four cents on $1.80 is the rate he charges us, and he is most satisfied with his commission. Beyond are bazaars with eatables and more with hats and clothings—stores with slippers and costumes—and in all of them the friendly natives, only too glad to let the "Amerikansky" look over their wares, if they may be permitted to stare at him in return. Bulgaria may be a brigand land, and there are parts of the southern frontier where it must be admitted we did not feel any too safe, but Bulgarian people as a whole are among the friendliest in the world to the stranger within their gates.

We turn into a road of cobblestones not five feet wide and take to the heights. The lowest story of the houses here is windowless, built of stone and mortar, with heavy wooden doors and heavier iron knockers, and a tiny barred window-let at one side of the entry, to serve as peep-hole before admitting the visitor. It reminds one of Ali Baba and the Forty Thieves, to see the donkey trains stop before these doors, while curious, turbaned muleteers knock and await admittance. Here the upper, slightly protruding second story is of plaster over lathwork—white save for a stripe of blue along every corner, or else left the hue of the dried mud that coats the laths, and adorned by Maltese crosses of pine beams. Here and there the lattices bespeak a Turkish harem; but the Turk has almost evacuated Bulgaria, and his call and his costume are rare. Out of this quarter, and in the next, the windows come still higher up the wall; the houses face sidewise, as in Roumania, and upon little gardens among the flagstones, and we come out on the tall, tapering fire-tower, the "center" of a Bulgarian town.

The view from this point and from a slight bluff just behind is one that is incomparable. Not even Naples at sundown, nor the Georgian Bay, nor the Bocches di Cattaro, can leave such a lasting impression as this; for they one and all lack the tintings of color that these tiers of homes on either side present, with the mountain frowning up beyond and an ancient Turkish mosque, of the sort that old Bethlehem has in the pictures, on the crest of its slope.

There was a tempting little tavern here, and we dropped in to taste of the native beer and the undried figs that the place afforded; then we continued the pilgrimage. We had found the East at last, the East of story books. The alleyways grew ever narrower—in fact, so shrunken that in spots men with the yokes for bearing water barrels on their

1. Going to Market 2. The Last of the Turks

shoulders could scarce pass. Where they broadened, verandas appeared on the street side of the houses, and there were little windows, into which we might peer, upon whitewashed rooms, with iron bedsteads and a few sacred pictures.

Some schoolboys, playing in the shadow of a garden wall, sprang to attention and saluted as we passed, and we noted their caps, the rims of alpaca, the top a flat piece of scarlet cloth, with a Maltese cross of gilt. Both boys and girls wear a set form of clothing in Bulgaria, altered just a trifle, according to their grade; so that if mischief is done by the young, one needs only to go through the particular schoolroom to find the offender. This uniformity likewise does away with the envy between poor and rich.

Again, a peddler passes by, but in Tirnova both these and the beggars are few. Peasants in costume are met now and then, though European dress has the preference.

In a booth, among the number of local views offered for sale, we find a souvenir post-card with the profile of Roosevelt. In contrast, pictures of Prince Ferdinand are decidedly rare; and yet the Prince is quite popular.

Tirnova is closing her shops for the night. The strings of flat, red, dried sausages, suspended before the booths, like a row of the seeds of the thorn tree, are being taken down. An army officer, in coat and cap of white and blue trousers, takes his roast of mutton, and the butcher shuts the door. The manna in the fruit stores is being stowed away, and where fancy candles are on sale a Turkish woman, her face covered save for the space between upper lip and eyelids, scurries by, intent on one last purchase. One building, much like an arcade, but open to the sky, houses a series of stores, and these, too, are closing.

We were going to enter some of these when Friend, in that convulsive way of his, grasped me by the arm.

"Look! Oh, look! *There* is the Pride of Bulgaria!" and he sighed nervously.

I looked in the direction in which his finger turned, and there, on the balcony, was a Madonna of the Balkans—one of those rare beauties of the south Slav race, which is not especially noted for its beautiful women, who linger in one's memory long after every other iota of their towns and homes has been forgotten. My Lady of Tirnova was a subject for the artist's brush, as we saw her, framed by the window of a quaint three-story home of pink, and with the flowers of the portico forming the base of the picture. Her eyes were of the brown-black of the lower Balkans; her skin was tanned to olive; her face had the smile of an upland girl, and her hair, parted in the middle, was of the hue of the raven. She was indeed a Juliet for a Balkan Romeo. Nor would she be party to the least flirtation, but, catching our eyes, she turned her head, showing a half dozen tiny braids emerging from the rear of the head-kerchief, and disappeared into the chamber. Friend went into the bakery below and bought a loaf of native bread "to munch," he said, though he fed the greater part to the pigs and the ponies we met on the Prince's highway; but I forbore to question, save to remark that the native folk were watching us askance at such extravagance. Bread is four full cents the loaf in Tirnova.

Three schoolboys, speaking French, followed us, and then became our guides, taking us where old Turks argued in the meat bazaar, among hanging, dripping sides of lamb, and where the ox teams drew the heavy carts into the noisy smiths' quarter, where countrymen, in turbans and striped shirts and bloomer-pants, brought their ponies to be shod; and then to the very outskirts, where the African buffalo is seen, nestling beside the carts to which he is hitched, while the peasant does his errands in the town or, later, builds his camp-fire at the bison's side, and, gathering his family about him, roasts the piquant paprika (the mango, or good angel of the Balkans) and drinks his wine, the scene resembling most a prairie encampment in our own

Peasants Visiting Tirnova in Their Garments of Lavender

West, back in the days when the Republic was young. Friend, however, was not interested. Juliet's image still hung in mist before his eyes. Not even the army officers at the fort, one of whom had been in New York, could shake off the dream; and so we turned to the hotel for supper; then I to the note book and he to—bed, while a graphophone on the floor below pealed out snatches from Carmen.

GEOLOGISTS IN CHINA

THE Carnegie Institution has just published the first two volumes of the report of its geological expedition to China in 1903-4. The report is entirely technical, being intended only for the information of geologists. But the authors have included a large number of unusually handsome illustrations, which give a general interest to the work. Through the courtesy of the Carnegie Institution, several of these pictures are printed in the following pages. With the exception of the extended geological research in China by Baron Ferdinand Von Richthofen, thirty years previous, this expedition by Messrs Bailey Willis, Eliot Blackwelder, and R. H. Sargent is the only geologic exploration of China that has been made, and the results obtained give the report unusual value to geologists.

MAP OF AFRICA

THE December number of the NATIONAL GEOGRAPHIC MAGAZINE will contain a large map of Africa, 15 by 20 inches and in seven colors. The map will show the latest explorations, giving the routes of the principal explorers of the continent, and also the possessions and spheres of influence of each European power. It will also show all railway and telegraph lines, constructed and proposed. In view of the recent rapid commercial development of nearly all sections of Africa, and present interest in Morocco and the Kongo, it is believed the readers of this Magazine will find the map particularly useful.

Photo by Bailey Willis, Carnegie Institution

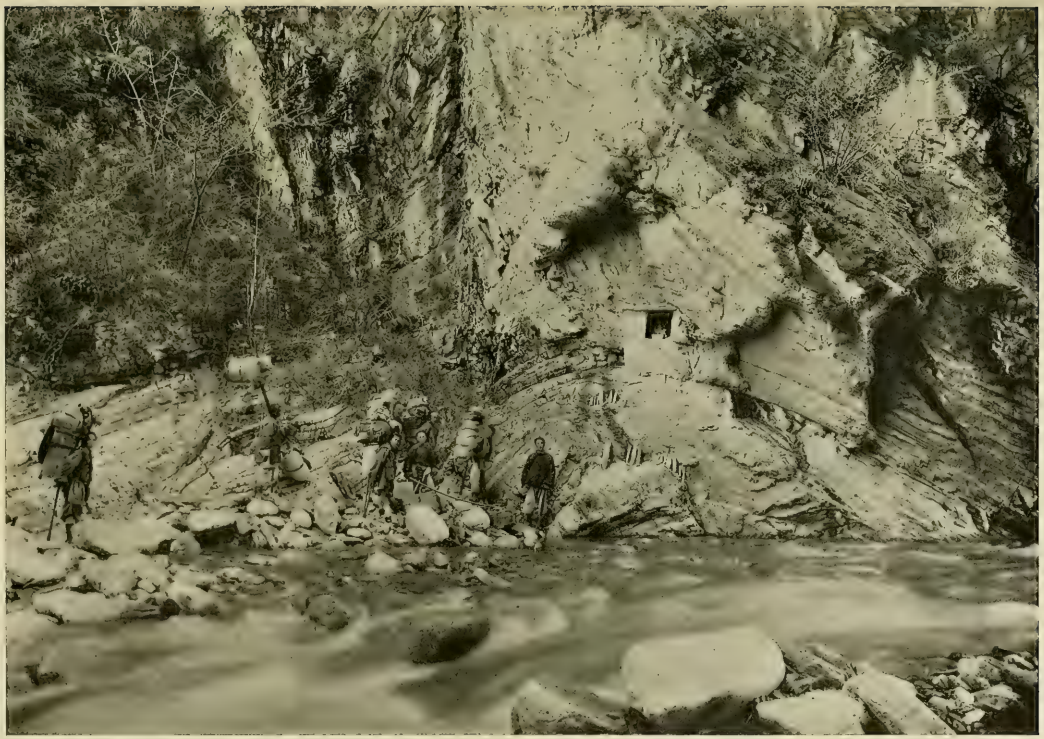
Cultivated Terraces in Central China

Photo by Bailey Willis, Carnegie Institution

Four Shensi Soldiers of the Governor's Guard, Central China

Photo by Bailey Willis, Carnegie Institution

Interior of Temple to K'wang-sheng-ti, the Great Warrior of the "Three Kingdoms" (221–265 A. D.)



In Canyon between Siau-wang-kien and Chiang-k'ou-shi, Shen-si

View of outcrop of slates of Hei-shui series. In the shrine on the cliff is a small idol and the stones set on end are offerings to the spirit of the dangerous ford. Coolies of the expedition. Photo by Bailey Willis, Carnegie Institution

Photo by Bailey Willis, Carnegie Institution

A Device Erected Before the Gate of a Chinese City to Ward Off an Evil Dragon

In a Date Orchard, Biskra, Algeria

Photo from David Fairchild

Photo from David Fairchild, U. S. Dep't of Agriculture

A Zanzibar Maiden

Photo from David Fairchild, U. S. Dep't of Agriculture

In German East Africa

Photo by Thomas H. Kearney, U. S. Dep't of Agriculture

An Unusually Fruitful Date Palm, Tunis

The heavy bunches of fruit have been "straddled" to prevent the breaking of the stalks

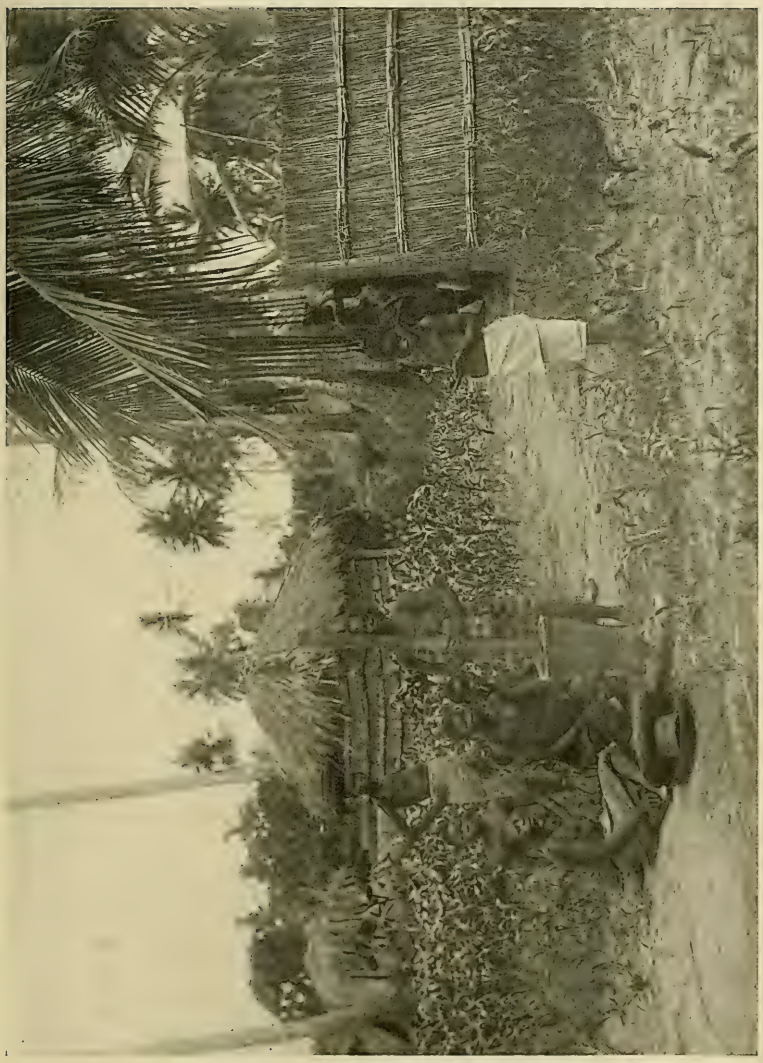


Photo from David Fairchild, U. S. Dep't of Agriculture

A Native Village, German East Africa

KOYASAN, THE JAPANESE VALHALLA*

By Eliza R. Scidmore

THE Japanese Valhalla, the national necropolis, the greatest graveyard in the Empire, is in the sacred green grove of cryptomeria crowning the summit of Mount Koya, in Kishiu, some forty miles east of Osaka, in the heart of the oldest Japan. The site was chosen eleven centuries ago by Kukai, the Tosa priest, best known by his posthumous title of Kobo Daishi, a most conspicuous and interesting figure in early Buddhism.

Kukai had a miraculous birth, an exciting novitiate, and, being sent to China as a government student, he succeeded to the mystic and occult doctrines of the yogi sect, as brought directly to China from India by two Hindu patriarchs and transmitted through seven chosen abbots to himself. Before he left the seat of continental culture and learning, with his sacred books, pictures, and articles of temple service, he hurled his mace, or *tokko,* in air, and it flew through space to land in the branches of a tree on Mount Koya—like the golden torje at Lhassa, which flew through the air from India. Guided to the spot by the celestial radiance streaming from the tokko, Kukai fulfilled his vows of building a temple there, and for the final years of his life he taught the mystic Shingon doctrines, the occult, secret laws, in the mountain-top monastery.

One meets memorials and traditions of Kobo Daishi in every part of Japan, but at Koyasan he is naturally all-pervading and supreme. That forceful person could have known no rest during his brief span of sixty years, for ten men could hardly have built all the temples and the shrines, carved the statues, painted the pictures, planted the pine and camphor trees, climbed the mountains, lighted the lanterns, started the sacred flames, or performed all the miracles attributed to him. He lived and moved in an atmosphere of the supernatural, it would seem, time doubtless adding to the number and quality of his miracles and attaching any stray miracle to his credit. It was his early manner, or first style in building, to construct a temple in a single day, bidding the setting sun stand still and light the workmen at their tasks—and in proof one such temple is shown intact today on the shores of the Inland Sea. At Nikko he persuaded the mountain priests and saints that their rude deities and Shinto spirits were but manifestations of Buddha. He raised temples and shrines there by the score, and hurled his brush across the Daiyagawa to write a Sanskrit word on an inaccessible rock, which every tourist may see distinctly to this very day. An image of Fudo which he brought from China was carried to the seat of domestic war, and after three weeks of ceremonies and incantations by a great body of Shingon priests, the rebels were overthrown, and the image remains the object of universal pilgrimage at the great temple of Fudo at Narita. He once exorcised dragons by spitting at them the rays of the evening star, which he held in his mouth, and he cast magic spells and transported himself, or his astral body, at will. His followers believed the great yogi to be the reincarnation of one of Sakya's disciples, and the scoffing priests of other sects were in time so dismayed by his miraculous power that they were converted, bowed to the pious juggler, and flocked to his temple of Toji, in the

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southern quarter of Kyoto, to be taught the mystic doctrine.

HOME OF MYSTICISM AND MAGIC SPELLS

While his powers and vogue were greatest he removed to Koyasan, whose seclusion was better fitted for the teaching and practice of yogi doctrines, the meditation and prolonged contemplation of the abstract that induces occult power. There mysticism abode. Incantations, magic spells, crystal gazing, and hypnotic trances, engrossed the company of expectant bodhisattvas, who in this coldly analytical day would be termed a company of neurotic priests, worn by fasting, exposure, and sleeplessness until subject to extreme hallucinations. It was a seminary for secular learning as well, since Kobo Daishi had brought back with him all the arts and culture of the Tang dynasty, when Chinese civilization was at the height of its greatness. Arts and letters were intimately connected with the new religion and the Buddhist priests were the disseminators of all Chinese culture. The monasteries were so many academies of continental learning, and the Emperor and his court were fervent disciples of the Chinese-taught philosophers. As painter and calligrapher, Kobo Daishi was foremost in his time, and his greatest service to his country was the reform of the syllabary, the introduction of the *hiragana,* by which forty-eight of the commonest signs were arranged in a fixed order—the whole syllabary giving the sense of one of the sacred Sanskrit sutras. For the benefit conferred by the new alphabet, he is regarded as the patron saint of calligraphy and the literary art, the deity invoked by all poets, painters, authors, and toiling schoolboys.

Priest and Women Pilgrims to Koyasan

100,000 PILGRIMS EACH YEAR

After a strenuous life of sixty years, he announced the day and hour of his death. A great conclave of priests assembled, and at the prearranged time the great abbot passed from meditation to trance, and was borne to the waiting tomb, where he sits today, sleeping in the peace of Nirvana, until Maitreya, the future Buddha, shall come. For this reason the Shingon Buddhists have believed that those who lie beside Kobo Daishi at Koyasan shall waken with the sleeping saint, the entranced yogi, and with him pass to the Great Pure Land.

After the lord abbot had fallen asleep on Koyasan in 838, he was canonized, given the posthumous title of Kobo Daishi (Great Teacher Spreading about the Law), and his tomb became a popular place of pilgrimage. One hundred thousand pilgrims visit his mountain-top tomb each year, and ten thousand and more climb the heights on the death anniversary, April 26. Many wait for that day to carry with them the tablets and ashes of those whom they would have translated to the future heaven with the saint, to Jodo, the Pure Land of Perfect Bliss. Even very aged people will insist upon the pilgrimage when they are unable to

The Images of Jezo, Benten, and Fudo

To throw water over them benefits the souls of ancestors (see page 663)

walk, and are hauled by ropes up the steep paths, with zealous children supporting them, lifting and placing their feet for them, since real merit cannot be acquired if one does not make the ascent on foot.

EVERY GREAT JAPANESE FAMILY HAS A MONUMENT AT KOYASAN

Every great family in the Empire has a monument or cluster of tombstones at Koyasan; the humblest may freely go and cast a fragment of a cremated body into the well in the Hall of Bones beside Kobo Daishi's tomb; and *ihais* or mortuary tablets are deposited by thousands in the temples and monasteries on the mountain summit, where there are morning and evening services in honor of these dead souls. The poorest go in pilgrimage with staff and bell, carrying a bit of incinerated bone to cast into the deep pit or ossuary, and the greatest repair there with all the state and trappings of luxurious woe to inter precious ashes or celebrate death anniversaries with splendid service.

A nobler setting or more splendid surroundings could not have been chosen for the group of temples that grew with the centuries in the midst of this forest primeval, for the *Koya Maki,* the species of evergreen cryptomeria peculiar to this mountain, lifts a rough reddish trunk high in air before branching, and its needle foliage is bunched in dark, blue-green masses that form dense canopies of shade. The vast cathedral aisles of Koyasan are rivaled only by the majestic avenues and Druidic groves of cryptomeria at Nikko. A great fire in 1844 destroyed the noble five-storied pagoda, the Kondo, or main hall. In 1888 a second great fire raged for two days and swept away priests' houses and small structures by the acre. In spite of such disasters, Koyasan still possesses many unique and splendid structures and

remains a treasure-house of ancient art. Koyasan's first temple was but the central one of a great group of monastic establishments that were gradually built round it, and the green grove rang with the voices of many thousand priests chanting the sutras night and morning in a thousand shrines. To found a monastery and mortuary temple on Koyasan was an act of great merit and the height of all religious ambition. It was the chosen asylum of those who would forswear the world, a refuge for retired and abdicated rulers, and its cemetery became the haven of heroes, the abode of saints, a hall of fame. Riches and revenues, lands and treasures, were heaped on the mountain communities through all the ten centuries before the Restoration. Every distinguished name in Japanese history, letters, and arts is graven there somewhere, either on the tombstone in the great cemetery or on the tiny *ihais*, that are ranged by thousands in the halls of tablets attached to each monastic establishment. Night and morning big bells boom and silvery gongs ring the call for services for these departed spirits; sacred flames burn continuously near them, incense rises, and fresh offerings are made each day.

POVERTY AFTER CENTURIES OF UNTOLD WEALTH

Held sacred for eleven centuries, Koyasan knew only honor and an increasing accumulation of wealth until the Restoration, when, with the downfall of the Shogun and the disestablishment of Buddhism, neglect and impoverishment came to the priestly commune. The lands were taken away, the rice revenue and tribute ceased, visitors and pilgrims were few, and the offerings scant. An anti-Buddhist governor ordered the closing of 1,000 monasteries, whose buildings and contents dropped away in mould and ruin. The contemplative brethren, who had never known rice-winning, production, nor industry of any kind, soon faced starvation. Beside the riches in statues and paintings with which Kobo Daishi himself had dowered the place, rulers, princes, and worshiping visitors had given it masterpieces of contemporary art; many rich collections were left the temples to secure perpetual services for the repose of the owners' souls, and the treasures stored in the two thousand temples and their godowns were incalculable.

The Restoration seemed to have sounded the downfall of the great establishment. Old priests died of discouragement and hardships, some priests returned to their families, others went out to active lay life, and the diminishing company on Koyasan's summit eked out a bare existence. The occasional surreptitious sale of a painting or art object from the enormous store of such gifts accumulating and lying unused for centuries supplied their immediate necessities. Enthusiastic purchasers boasted so loudly at the capital of the treasures of art they had acquired in temples in the hinterland that suspicion fastened upon Koyasan. An imperial commission was deputed to visit Koyasan, investigate, catalogue, and photograph what remained—all such objects thenceforth to become definite and inalienable "treasures of the Empire." It was then that the great fire of 1888 providentially destroyed neglected monasteries and godowns suspected of spoliation. Koyasan's treasures have especially enriched three great collections in America, and serve a noble purpose in spreading abroad the superior glory of oriental art.

The remote, mountain-top monastery and necropolis has best preserved its ancient atmosphere to this garish day of progress; has longest retained its sacredness and seclusion, its atmosphere of old Japan, and of true religious calm. In those Druidic groves contemplation, meditation, and sacred offices seem naturally the sum and end of daily life. It is the most elevating, inspiring, and deeply touching place of religious pilgrimage in all Japan, and until the storm-time succeeding the Restoration, the rigorous Buddhist rules forbade women to set foot upon the sacred mountain—for which

reason, probably, they are the most zealous and numerous visitors now. Before Dr Dresser's visit in 1878, who went at the request of the Japanese government to view its art treasures, only three foreigners had visited Mount Koya, and their numbers were rarely equaled for many years afterwards. Until the railway penetrated the valley of the Kinokawa, there was a long jinrikisha ride of forty miles preceding the steep climb on foot or the penitential ride in kago for nine miles up the steep side of Koyasan.

The last part of the ascent is very steep. It needed all of Kobo Daishi's engineering skill to lead the path up by forty-eight turns. Wherefore it is called the I-ro-ha-zaka, in allusion to his arrangement of the syllabary beginning with those characters. The kago, which is a luxury of comfort for the Japanese, with their flexible, well-trained joints and philosophic, acquiescent temperament, is a penance for all his sins to the foreigner with his useless bulk and unaccommodating knee-joints, and he is usually willing to acquire merit by climbing that last half mile of the I-ro-ha-zaka on foot.

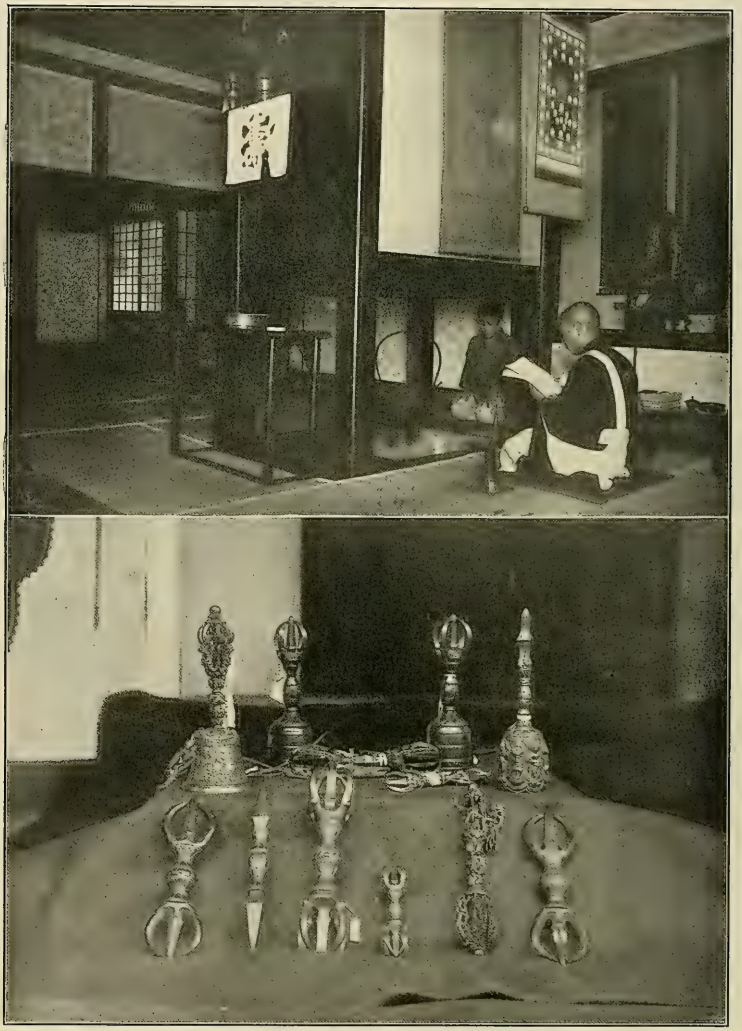
A rude temple to Fudo guards the black back gateway, and everyone pauses. A discriminating pair of priests appraise and classify arriving pilgrims, and one is billeted, as his consequence and quality or his credentials declare; either to the gold-walled, silk-bordered mats of the abbot's palace, to lesser monasteries, or to the plain houses for the plainest people attached to the plainest establishments. The unknown foreigner and his professional guide are usually assigned to the least pretentious places, bundled in with Osaka shop-keepers, and rated with the lower middle classes generally. Save when he comes directly accredited by some other religious establishment or official patron, the rooms closed in with priceless gold-leaf screens, with Chinese paintings in the recess of honor, are not for the casual barbarian, with his clutter of baggage and belongings, his lunch basket, his coffee-pot, his greasy stuffs, his innumerable tools for eating, his disorderly, crumb-scattering habits, his monopoly of a whole room for his one inferior person. The priests expect all visitors to conform to the strict rules of monastic life and their vegetarian diet, since all who come are entertained without charge.

THE SERVICES IN THE CHAPEL

While we dined in space and seclusion, conversation toned down by our religious surroundings and great fatigue, a merry chatter came from rooms beyond, where assembled visitors were grouped sociably at the evening meal, all of whom had walked the steep miles up the mountain, bringing tablets or relics. When the Taiko's great bell boomed softly nine times from the fortress-like bell tower, there was a scurrying of feet and banging of screens, and the priest came to request any visitors to withdraw, before the outer gate was barred for the night. The clear ringing notes of a small silver gong summoned all the monastery company to the chapel for the regular evening service or mass for the dead souls whose tablets are guarded there.

We followed our young priest to the two halls of service, each with elaborate Shingon altars, richly painted ceilings, with ranks and rows of gold-lettered ihais completely hiding the walls. Some ihais were enclosed in reliquaries, and food offerings were ranged on shelves below all the ihai. A frieze-like curtain of gold brocade surrounded each hall and long banners and strips of the glistening fabric hung against the pillars and columns, all finished with gilded bells and metal ornaments. The head priest, in his yellow robes, over which he had thrown a brocade cloak (*kesa*) of flame color shot with gold and caught with huge purple cord knots, sat beneath a red and gold baldachin, with the low table before him covered with an elaborate Shingon altar service. Five priests on either side sat statuesque in ceremonial dress, chanting responses and striking silver-toned cymbals at intervals. The high priest

The Hall of Tablets at Shoji-shin-in
The Treasurer and His Assistants



The Fireplace at Shoji-shin-in, an Invention of Kobo Daishi's (see page 666)
Kobo Daishi's Golden Tokko; Other Tokkos and Bells

read the sutra and the acolytes responded, and for a half hour after there continued the rhythmic, sonorous chant, broken now and then with a short obligato from the immovable head priest and a clash of silver cymbals. The head priest laid incense on the coals in the golden lotus cup, and one by one the ten priests advanced and reverently added to the perfumed cloud that dimmed the room. Five visitors, who had come to engage a special mass or memorial service for the repose of the dead souls of relatives whose tablets are kept in the monastery, had continued a fervent repetition of the name of Buddha throughout the mass.

After the regular vesper service for all the tablets this little family group drew near the priest, made an offering of money in white paper, and with a second special chanting of sutras and burning of incense the five mourners were made happy. Receipts written on large papers were given them, and as thicker incense clouds rose the acolytes began extinguishing the candles, until only one perpetual flame, a tiny wick in a saucer of oil, was left in the temple for the night.

At five o'clock the next morning the booming of great bells far away and the clear silver strokes of the chapel gong summoned the priests to a similar service for the repose of the dead souls. Soon the measured chants and the ring of the silver gong rang upon the sunrise air; then the thump of stockinged feet on echoing boards told that the faithful were returning from the chapel, and the buzz of voices began again in the guest-rooms and refectory. Later, the acolytes set fresh cups of tea and bowls of rice, new pyramids of fruits and shreds of food before the ihai, and the halls of tablets were left in silence until the vesper service.

SEVERE DISCIPLINE, FASTING AND VIGILS

This Shingon (True Words) sect, which Kobo Daishi founded, retains its original features as it came from China, and its ritual and symbolism, its mystic signs, gestures, finger manipulations, and practices, are derived most directly from the Hindu. By the mastery of the True Word and of the secret laws of body speech and thought, the Shingon priests believe they may attain Buddhahood while in their present physical bodies. Like Kobo Daishi, they practice the most severe discipline, endeavoring to reach the higher stages and perfection by prolonged fastings and vigils, by the continued repetition of sacred words and formulæ, by the contemplation of sacred pictures and crystals and by the contemplation of the abstract and absolute. Passing into the trance or hypnotic stage, they have transcendant visions and they enjoy supernatural powers. All the mysticism and ceremonial of northern India and China are embodied in Shingon doctrines and rites, and the most profound European students of Japanese Buddhism openly say that the Shingon doctrine is as well nigh impossible to comprehend as it is to express it in comprehensible language.

In the Shingon sect the same household marks and symbols are traced at the doorway as in India, and there is a great ritual of finger manipulations, signs, and gestures peculiar to this one sect. A very few of these mystic signs are evident to or known by the congregation, as the priests perform them within the folds of their ample sleeves or when facing the altar. A chart of a few of the simpler Shingon gestures was published some years ago by the Musée Guimet, in Paris.

THE GOLDEN HALL

The Kondo, or Golden Hall, of Koyasan is one of the most splendid temple buildings in Japan, vast in outline and richly decorated in its interior. The inner or truly Golden Hall, a pillared space surrounded by broad, matted halls for the congregation on three sides, is one blaze of gold and brilliant decoration, from the floor to the gorgeously paneled ceiling. The elaborately gilded altar stands with its ornaments against the golden wall, and under the great jeweled baldachin the square altar tables are loaded with the innumerable golden objects used in

Main Avenue in the Cemetery, Koyasan

Another View of the Main Avenue of the Cemetery, Koyasan

Danjiro's Tomb

Danjiro was the most famous actor of recent times

Image of Kwannon, the Goddess of Mercy, in the Sacred Grove, Koyasan

The Traitor's Grove (see page 664)

Tombs of a Daimio

Shingon services. The precious old altar pictures were saved from the flames and hang again in exactly their same places, and the spaces above the beams and in between the massive keyaki columns are filled with panels of open-work carving, richly gilded and colored, all glowing in the soft splendor of this golden gloom. It is cold and damp, however, in this jeweled interior, where few sunbeams ever strike beneath the low eaves or through the high wall of koyamaki trees; and on chilly mornings there is a deathly, marrow-piercing chill from the cold, wet matting that explains the hacking coughs and feeble steps of the wan and bleached ascetics who spend hours of meditation and services each day in such places.

THE CEMETERY

The feature of Koyasan in all the centuries, however, has been the cemetery—a great company of gravestones crowding close along either side of the main avenue for more than two miles. In stone-fenced and torii-guarded enclosures are clustered the granite monuments of emperors and shoguns, of saints and princes, priests and laymen. The names of great generals, great traitors, patriots, poets, and actors, of the old daimios and the new nobility and the captains of industry occur side by side.

No horse, nor wheel, nor kago may desecrate this noble forest temple of the dead, and one must walk the sacred ground from the first entrance bridge to Kobo Daishi's tomb. The Hall of 1,000 Amidas breaks the journey—a low, dark temple hall, where the gilded company of images disappear in the dim shadows and gloomy perspective. Near it is enshrined the most venerated image of Kobo Daishi, carved by himself, and time-darkened paintings of the Buddhist celestial worlds from his inspired brush. A row of "wet gods" are ranged near a temple of Dai Kokuya, well modeled bronze images of Jozo, Fudo, and Dainichi seated on stone pedestals before a water trough. The pilgrim clasps his hands in prayer and tosses a dipper of water full in the face of the image; another prayer and another dash of cold water succeed, until the bronzes are wet and glistening and the believing one departs, assured that his prayer for the good of the souls of his ancestors will be heard.

The supreme test for all is to pass over the Bridge of Morals. Unless one is possessed of a pure and clean heart and can meet Kobo Daishi's strict requirements, he may not cross that bridge whose thirty-seven planks are marked with the names of that many Buddhas. It is related that when the Taiko, the great Hideyoshi, first came in worshipful pilgrimage to Kobo Daishi's tomb he had such misgivings and heart-sinkings as to his moral acceptability that he stole away with the high priests at night and tested the ordeal of the bridge secretly, that he might be spared any disgrace in the presence of his suite.

THE HALL OF 1,000 LAMPS

The Hall of 1,000 Lamps fittingly leads one nearer to the saint's tomb, for since the Emperor Toba (1108) made a great service with 10,000 lamps in honor of Kobo Daishi in this chapel erected by the great abbot's nephew, a lamp has been considered most suitable and acceptable offering to a Shingon temple. Here they hang and stand by hundreds and tens of hundreds, ranged on stone tables and hanging overhead far back into the dim distance of the darkened interior. Eight thousand lamps are in there now, 150 burning each day, even through the deserted winter months, when snow lies deep on all the forest paths and the priests must melt the sacred oil that feeds the flames. On special days in each month 1,500 lamps combine their glow-worm flames and fill the hall of shining brasses with a rich glow; and on the death anniversary in April the whole 8,000 unite in gleams of praise to the sleeping abbot. If one light a lamp in honor of Kobo Daishi he is saved from being driven to the dark river of hell and is carried on to the Pure Land with the saint himself. Emperors and shoguns have lighted

lamps past counting, but more acceptable are the lamps of the poor, one that perpetually burns being the little brass lamp of a widow. The big globe of an incense-burner at the doorway sends its incense clouds through openings cut in the shape of Sanskrit letters, and the paths around this temple and the tomb are traced on the lines of Sanskrit letters, and while treading the holy words of prayer one should also repeat them.

The Octagonal Hall of Bones flanks the tomb of the great saint, a deep pit or ossuary, into which are cast the bits of mortality from all over Japan, such ashes and bones assuredly to be carried with Kobo Daishi into the Pure Land. A lichen-covered stone fence surrounds the vault where the lord abbot sits in his trance awaiting Maitreya, the future Buddha, the Messiah, with whom he is to have a final argument on matters of doctrine before entering Nirvana. Seventy-seven years after Kobo Daishi's death, the Emperor sent new robes for the sleeping saint, and after long preparation the abbot of Koyasan entered the tomb and found the entranced one sitting with long, matted hair and beard and tattered clothing. The abbot shaved and dressed the sleeping one reverently, but the priests who were with him saw nothing at all, as their superior made motions in the air as if dressing and shaving some one. Not until they had sunk themselves in deeper absorption, after more intense prayer, were they able to feel the lines of the cold body as the abbot guided their fingers. Their eyes were then dimmed with tears and with the celestial radiance that flooded the vaulted tomb. A great stone was laid over the entrance and the place closed for all time, the abbot fearing the result, if for some want of merit his successors should not be able to discern the saintly person. Emperors and princes continued to send offerings of clothing each year, and the abbot still goes in state procession and lays them on the altar table in the Hall of Lanterns on the anniversary day. Then Kobo Daishi miraculously assumes new garments as he needs them, without mortal aid, and one may see the rolls of silk and imperial offerings, by the altar table in the little temple, awaiting this last incarnation of one of Sakya's disciples.

SPLENDID MONUMENTS AND TABLETS

The stone monuments of the early emperors stand on mounds of earth, the simplest memorials there, while the Shogun Iyemitsu has the most splendid monument on the mountain. The poets and painters of the great ages are all in evidence, and the Lord of the Forty-seven Ronins and the patriotic Ii-Kamon-no-Kami, who opened his country by the treaty with Commodore Perry and lost his life in expiation of the deed, are also there, and great Saigo, with his heroes of the rebellion of 1877, are there too. All the old feudal princes have their sotoba tombstones of Bizen granite, accompanied by stone lanterns that are lighted on memorial and festival days. The daimios of Suruga and Aki have the largest monuments, but the memorials of the princes of Sendai, Satsuma, and Kaga are also noteworthy. The houses of Date of Sendai and Nabeshima of Hizen have small memorial temples in the village near the entrance of the cemetery, with priests' dwelling-houses attached, where the members of those families stop when they come for interments and anniversary celebrations, where the tablets are kept and tended. The grave of the traitor Akechi Mitsuhide, a great granite sotoba split by lightning from the onion cap to the great heavy plinth and held in place by wooden braces, is a most eloquent witness of the wrath of the gods and of Kobo Daishi that he should venture there, and arrests the Japanese visitors more than any other monument.

Danjiro, the great actor of the Meiji time, has his granite tombstone, with his well-known crest of three linked rings, on the main avenue, and in this commercial, material age, *Kabushiki* (the joint stock company, limited) has even reached Koyasan. Clubs of merchant folks and working people combine in life to erect an elaborate monument, a splendid bronze Jizo or Kwannon on a

granite base, on which their names are inscribed.

The Russian War brought pilgrims and visitors to Koyasan in great numbers, and the tablets mounted to unusual thousands in the first year. Regimental groups united in sending tablets to Koyasan, and it must have comforted many, who died in agony on the field, to know that in death their spirits would be free to seek the cool green forest aisles and the golden temple rooms on Koyasan; to rest there with saints, priests, and princes; to be tended and remembered each night and earliest morning; to have reverend priests interceding for them in deep-voiced chants amid clouds of incense as dense as battle smoke and Manchurian dust.

RECEPTION BY THE LORD ABBOT

One morning the feeble old Lord Abbot received us in his Golden Audience Hall in the Kongobuji, and his was an ideal presence. He was of such venerable and saintly mien that it was not all etiquette that made us slip from the foreign chairs to our knees and prostrate our foreheads to the mats in the presence of that noble prelate in his splendid ceremonial robes. The delicate face, blanched with illness, refined by suffering and the religious life, the splendid purple garments and small red brocade kesa, like the begging sack of earlier priests, made a picture in that room paneled with severely plain gold screens. The ceremonial cakes and tea were brought, the venerable abbot made the sign of serving us, and a young priest put nearer to us the lacquer trays, with their exquisite arrangement of impressionist shells, sea waves, octopus, and red tai fish. The abbot told us of the 50 years of his life spent on high Koyasan; how he came as an acolyte at seventeen years of age, and for sixteen years past had been the Lord Abbot, the successor of Kobo Daishi. A few more minutes seemed to exhaust his strength, for he had been carried in from a sick bed to do honors to the friends of a court official and of a brother priest. Two priests lifted the invalid to his feet and assisted him out through the golden fusuma, and we knew that we had been in the presence of a living god.

HONORING THE DEAD SOLDIERS

All the Kongobuji and its treasures were thrown wide to us, and we were conducted past gold screens on which Sesshiu and the greatest of the Kanos had drawn their brushes, to a corner apartment, the room where Hidetsugu committed hara-kiri and where a Kakemono by Sesshu was temporarily hung across four gold fusuma panels painted with white herons on snow-laden willow-trees by Kano Motonobu. After that artistic climax, that Pelion of Sesshiu heaped on the Ossa of Kano, words failed, and we went on in dreams to see bamboos in the snow, as painted on long series of screen panels by Motonobu, and blossoming plum trees by Tanyu. After that came the inner sanctuary and chapel of the monastery—the imperial chapel, as it were—where the ihai of the last Emperor and Empress and of members of the imperial family are ranged at either side of the reliquary containing the tablet of Kobo Daishi. A plain white pine board erected in the midst of this golden splendor amidst the ranks of gilded lacquer tablets, is inscribed in black "to the souls of those who died in the war of 1894-95;" and to the common people it is inexpressibly comforting to see the tablet of the soldiers enthroned with the ihai of the imperial ancestors, worshiped and tended as they are tended for all time. During the Russian war a most conspicuous object on the altar of the Golden Hall was another plain pine tablet inscribed "to those who are dying daily in Manchuria," and the same tablet was set up in nearly every Buddhist temple in Japan, which also celebrated monthly *Segaki* services, or "feasts of hungry souls," while the war endured. The head priest of our monastery at Koyasan showed a book, into which he had pasted all the official lists of the dead soldiers and sailors, and holding this

book under his hand during the daily services, he prayed for all the hero souls. In the same way, each monastery has tablets to the souls of the dead poor—of those who die too poor to have their names put on an ihai for home altar or temple, or without descendants or relatives to revere their memories. When the head priest read the tale of heroism and loyality of the men on the *Kinshu Maru,* sunk off the Korean coast early in the war, he made an ihai himself and placed it near the altar. Many other priests and laymen throughout Japan did the same thing, as the honorable death of the Nara soldiers who went down with the little transport is one of the finest instances of the samurai spirit, of pure Bushido, a heritage to the people for all time.

We spent that rainy afternoon on the steps of the treasury of the Golden Hall. The treasurer, two priests, and a lay brother brought from their boxes and wrappings the most sacred objects and relics which Koyasan possesses. We touched the ponderous gold maces which Kobo Daishi himself had used, the bells which he brought from China, the golden images, the *sharidens,* or reliquaries, which he kept in his own little oratory, and his original Chinese rosary of black wooden beads in a crumbling box of old Kambara lacquer.

At the end of two rainy hours' session with the treasures, the arrogant lord treasurer had worn off his grand manner, was frankly and charmingly sociable, and in an excess of good feeling carried us off to his own dwelling, an ancient brown-eaved wing of a monastery, in a region of weed-grown foundations where great buildings had been. The rooms were simple, the screens and fusuma severely plain, but when the shoji were slipped aside they disclosed one of the most beautiful of the thousand and one famous monastery gardens on Mount Koya.

On the 21st day of each month, known as Kobo Daishi's Day in all the temples of his sect, there are special services in the Golden Hall, when the ten high priests from the ten monasteries of Koyasan, with their suites, assemble for an early morning service. In the golden gloaming the ranks of brocaded priests, the splendid chanting, the silver strokes of the altar gongs, and the curling incense make a powerful and affecting appeal to the religious emotions.

The high priest of our monastery came each evening for a ceremonial call, bringing now one treasure from his storeroom and then another. Once it was the Taiko's account book, detailing the expenses connected with the erection of the great Dai Butsu at Nara; and at another time the journal of the Lord Abbot, describing the events during the time when Nobunaga, having suppressed and destroyed the Tendai monasteries on Mount Hiyeizan, turned to Koyasan as another priestly stronghold needing annihilation. Finding the abbot and his council to be foes of another mettle, when once disturbed from contemplation of the abstract, he called off the forces of war and the Shingon priests were left in peace.

One sunny afternoon the priestly host took us to neighboring monasteries on a quest for gold screens and picturesque fireplaces. The box fireplace in the middle of the room, with a square chimney continuing like a massive column to the roof, is the invention, it is claimed, of Kobo Daishi himself, and the little gabled roofs protecting these chimneys project from nearly every roof on Koyasan. Even in April and September, the nights on the mountain top are sharp and frosty, and the vast sunless caverns of stone-floored kitchens open to the rafters of the lofty roofs, are like ice caves, save for the comforting atmosphere around the columnar fireplace, where the kettle hangs simmering from the crane and the embers glow. The same fireplace is found in the Lord Abbot's reception-room, and in the halls where the young monks gather to read their devotional books.

Around the corner from the Taiko's bell tower, where the bronze statue of Kwannon looks serenely across the great

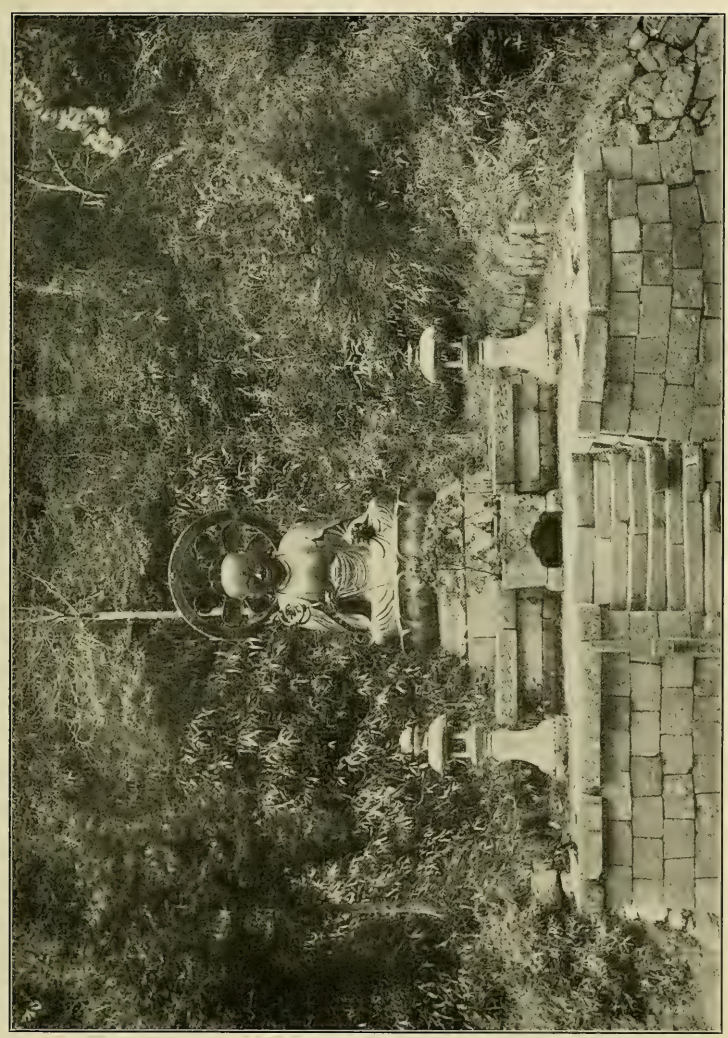


Image of Jizo San at the Entrance of Koyasan

The Head Priest of One of the Monasteries of Koyasan

square before Kongobuji's gateway to the village street, green lanes lead to other lanes, to deserted avenues and aisles in koyamaki groves, where the white walls, black rafters, and black roofs of monastery gates and buildings are continuous. Such a deserted monastery is Muriojo-in, whose painted wooden doors open to corridors, where, in long series of rooms, the most beautiful gold screens slumber in darkness and icy, deserted dampness.

On another afternoon we visited the head priest of the Shojo-shin-in, the second greatest establishment now existing in Koyasan. It has been rebuilt since the fire, which spared only its godown, and the few screens, altar treasures, and tablets that were carried to safety. The hall of tablets is the largest on Koyasan, severely splendid in its black lacquered ceiling and shining dark floor, and the walls are completely hidden by the thousands of ihai rank on rank.

The first reception-rooms blazed with the glow of reflected sunlight on the new gold-leaf screens that are without decorative designs, and treasures incalculable lay all over the floor of one room, where the boxes of precious Kakemono had been brought in, in preparation for an airing. There was a glowing Okyo screen, where the red rising sun rose above tossing waves, and a pair of Tanyu's dragon and tiger screens in sepia on gold that held one reverent. Another pair of Okyo screens were brought forward and opened out in line to show the greatest landscape view of Japan—Fujiyama rising from the plain, with the forked peninsula of Mio-no-Matsubara at its feet, central in a scene of ideal beauty. Gold screens with white herons on snowy pine trees and gold screens with snow-laden bamboo branches excited our strongest raptures; and then we were conducted past princely guest-rooms, up a steep staircase, and up yet another staircase, across a garden, and came out on a large tea-room far up on the steep hillside, the veranda overlooking the monastery roofs, the line of village roofs and commanding green summits beyond—the moon-viewing pavilion of the hierarch.

THE MOST WONDERFUL RELIGIOUS PAINTING IN JAPAN

We waited for the skies to clear before making reverent pilgrimage to Shimbe-sho-in to see that greatest religious painting in Japan—the *Amida Ni-ju-go Bosatsu,* or Buddha and the twenty-five Angels, painted by Eishin Sozu for one of the Hiyeizan temples, and later bought for the Koyasan shrine. Shimbe-sho-in is the remotest and least visited of the monasteries on remote Koyasan. "Koya no Koya," said my priestly guide, who wore a white cotton overcoat to keep the rain drops from his rich silk coat, as he followed the narrow path through the woods, a minion following with the useless red-ribbed umbrella of ceremony under his arm. It hardly seemed possible that a great temple and the supreme shrine of Japanese art could lie beyond the deserted foot path gullied by the rain, where we brushed the undergrowth at every step. The path led up steep slopes and plunged down steep slopes between koya, pine, and hinoki trees, and at last we crossed a tiny foot-bridge of approach, before a massive white Chinese gate, its solid arch topped by an intricately bracketed roof. White-walled buildings, showing rafters and timbers of dark-brown, unpainted wood, surrounded the small court-yard, and we entered the severely plain waiting-rooms—white plastered walls, white paper screens, unpainted wood frames and beams, wholly without decoration or ornament of any kind. The Shimbe-sho-in belongs to the Ritsuo sect, one of the six earlier sects established at Nara in the early centuries of Buddhism (753), when eighty priests came from China to teach the Vinaya doctrines and were settled at the Todaiji by the reigning empress. Meditation and contemplation are great features of their religious observances, but their ritual is less elaborate, and the austere simplicity of their temple and monastery halls is in contrast to the gorgeous splendor of the Shingon establishments in Koya proper.

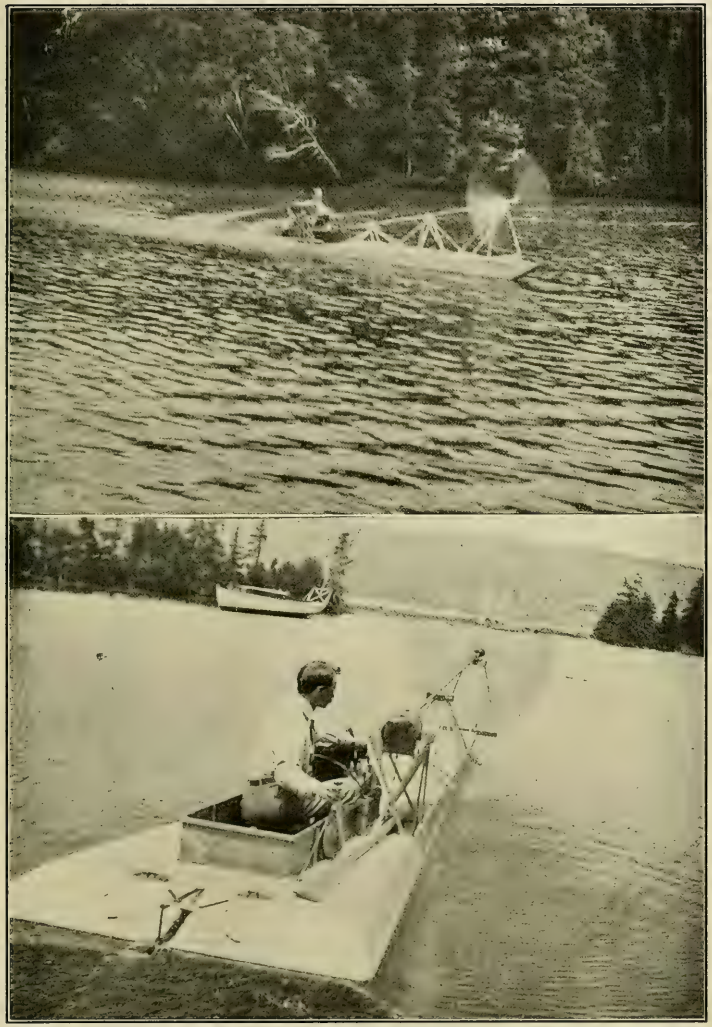
After long waiting, which was supposed to be spent in meditation, that we might approach in a properly reverent frame of mind, we were conducted to the veranda, to again cleanse hands and mouth before the solemn young priest led the way into the temple, where richly carved panels and beams were devoid of gold, or lacquer, or color. Immediately at the front of the great hall, in the full light reflected from the court, hung the three scrolls that combine in the one great painting. Before lifting our eyes to the luminous deity and the angelic host in the golden glory of paradise, we were given a pinch of incense to rub on the hands and a clove to hold in the mouth. Standing with hands clasped in prayer like our priestly leader, we knelt, prostrated our heads to the mats three times, and then were free to sit back on our heels and look at what is certainly one of the world's greatest paintings, the most splendid picture which any Buddhist temple in Japan has ever possessed. This and the Mokkei "Kwannon" of the Daitokuji are admittedly the greatest creations of Buddhist art. It has once been photographed, but in black and white the wear and tear of ages are too conspicuous and disturbing; and once a painted copy was made, but these copies are all difficult to get and unsatisfactory. This incomparable picture makes a fresh and first impression, when one's eye rests upon the golden Godhead, or, Amida—Buddha of all Buddhas, Lord of the Western Paradise—floating in a golden cloudland with a host of angels in brilliant garments sweeping through the flame-like clouds, escorting souls to paradise. The whole is the richest color study, the noblest composition, eloquent of the deepest religious sentiment and the most poetic feeling, and the action, the movement of the angels, and the flame-like clouds are marvelous. We sat rapt before the radiant scrolls, in the damp and lonely hall of the temple, drinking in and trying to memorize this supreme sight of a lifetime, this greatest picture of the middle ages, painted by the priestly Eishin, or Genshin, one of the founders of the Jodo sect, the Fra Angelico of Japan.

The solemn young priest broke the spell by a slight sound in his throat, when he thought our trance had lasted long enough. We offered incense, laid our thank-offering of money folded in soft white paper on the low stand, and reverently withdrew.

We went back to our monastery of Eternal Felicity and followed the broad avenue to the Dai Mon, the great south gate of the Koyasan enclosure. Pilgrims from Wakayama still arrive by that path, but the massive gateway has a sadly deserted air, its niches are empty, and it is blocked by the huge timbers that are being assembled for rebuilding the great pagoda. The view from this gateway is one of the renowned landscapes of Japan, and not the humblest pilgrim passes on without stopping on the plateau terrace outside the Dai Mon to look out over the descending woody foreground to the narrow valley cutting southward, and on across over all of Kiishiu province and the Kii Channel to the long point of Awaji Island cutting the Inland Sea, with the blue crests of the Sanuki Mountains on the horizon.

"I have never been to Koyasan," innumerable Japanese have said to me, "but of course I shall go there finally—when I am dead. We all do—we must."

"And I went there in 1868," said the Grand Master of Ceremonies at the Imperial Court. "I led 2,000 men from Kyoto around through Yamato to Koyasan, to come down upon the Shogun's forces at Osaka from the rear. I would like to see my samurai now, as they marched through the cemetery. We all wore armor and helmets and long swords. We were a picturesque company of fighting men then. It is not the same now, when war is all machinery. But Koyasan is at least unchanged. It never can change, nor our souls change. It is Yamato Daimashi, the Soul of Japan. We all go there. They cannot disestablish nor purify the dead."



Photos by Gilbert H. Grosvenor

Pictures of the "B B"

An experimental boat of Dr Alexander Graham Bell, driven by aërial propellers. The boat carries a 20-horse-power motor, weighing about 115 pounds. The motor was built by G. H. Curtiss, of Hammondsport, N. Y. The boat, which has attained a speed of nearly 10 miles an hour in smooth water, is used by Dr Bell to test the efficiency of aërial propellers of different designs. In the pictures it is being guided by Mr Curtiss.

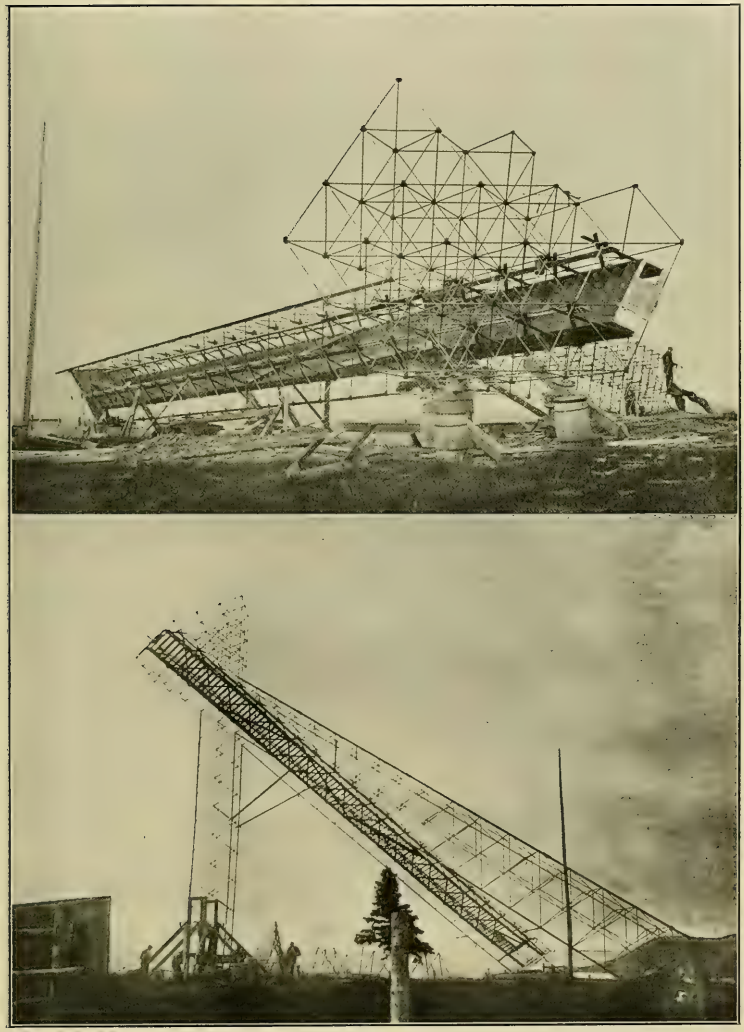
DR BELL'S TETRAHÉDRAL TOWER

AN outlook tower, unique in design and construction, has been recently erected by Dr Alexander Graham Bell at his summer home in Baddeck, Nova Scotia. The tower reaches a height of nearly 80 feet, and yet neither scaffolding nor derricks were employed in building it. It is made of the tetrahedral cells invented by Dr Bell and described by him in the article on "Aërial Locomotion," published in the January, 1907, number of this Magazine. The accompanying illustrations represent the process of construction. Picture 1 shows several piles of tetrahedral cells made of ordinary galvanized iron piping. These cells were riveted together until two legs of the tower were completed and joined at the upper end, as in picture 2. The third leg was then shoved up by jack screws, successive layers of cells being constantly added, as in picture 3. The completed tower appears in pictures 4 and 5.

This considerable structure weighs less than 5 tons, and yet can carry a great weight. It is remarkable, not only for its strength and lightness, as well as cheapness, but also for the fact that it was put together in about 10 days by several unskilled laborers, and that every part of the work was done on the ground. No one was obliged to leave the ground until the tower stood erect and completed. Mr C. Baldwin, C. E., of Toronto, superintended the construction of the tower.

Photo by Douglas McCurdy

1. The Tetrahedral Cells, of which the Lookout Tower was Constructed



Photos by Douglas McCurdy

2 and 3. Illustrations of the Tower during Construction

Showing how it was put together on the ground, and raised without scaffolding or derrick

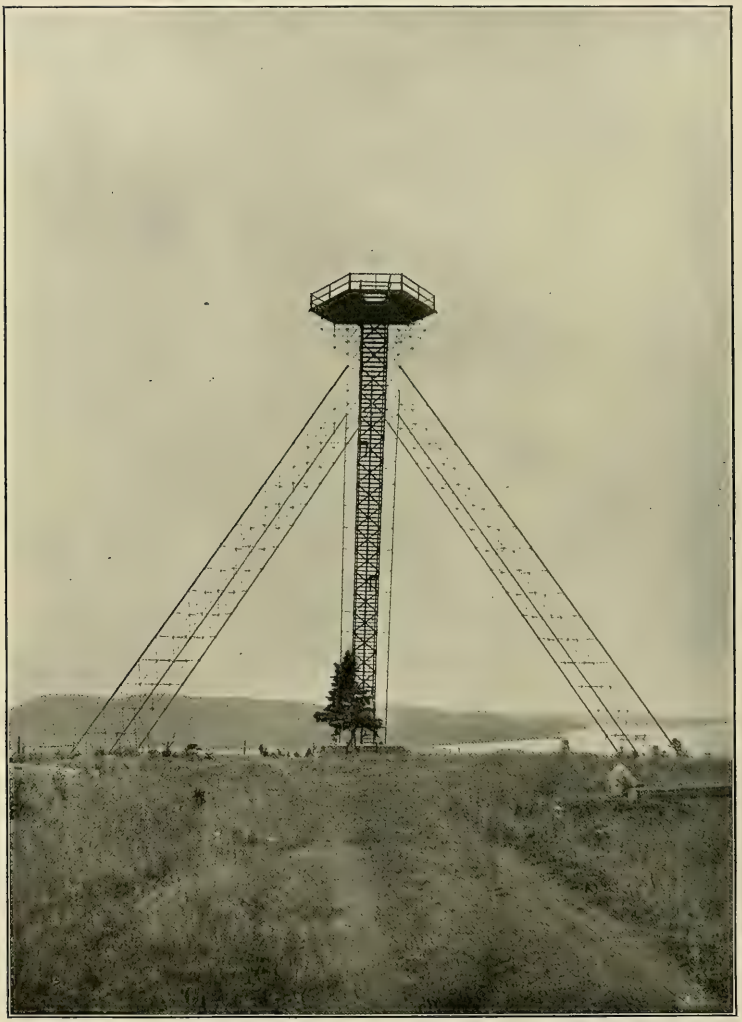


Photo by Douglas McCurdy

4. Tower of Dr Alexander Graham Bell, Built of Tetrahedral Cells

The tower is 75 feet in height, and weighs less than 5 tons

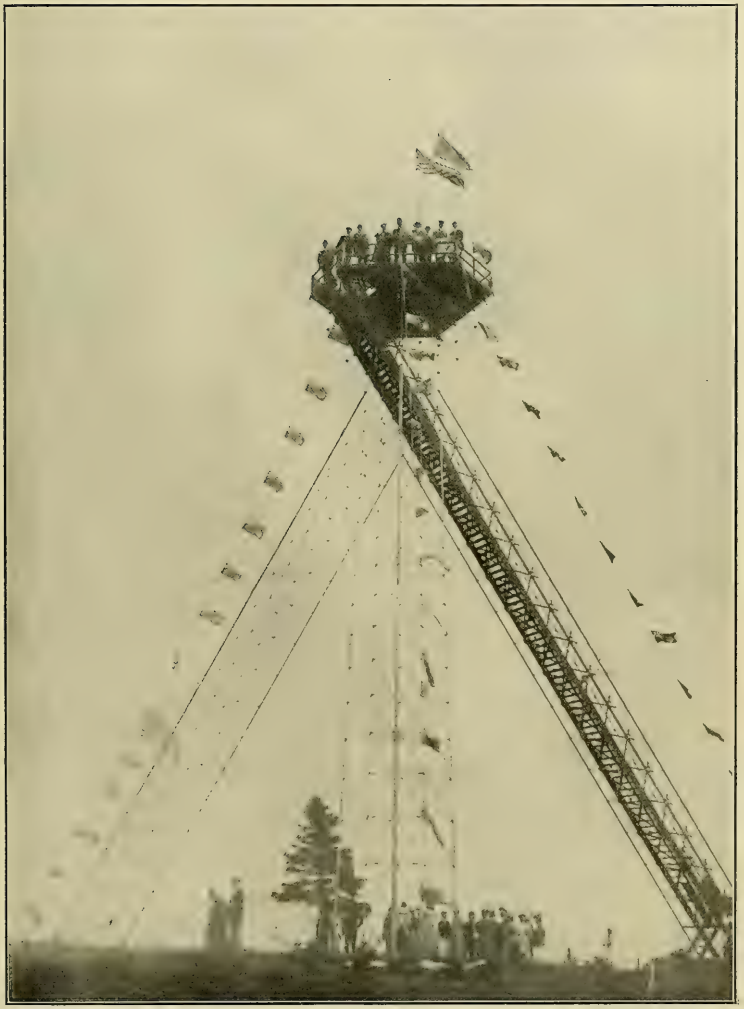


Photo by Douglas McCurdy

5. Another View of Dr Bell's Tower Taken on the Opening, August 31, 1907

The stairway is placed inside one of the legs

Outline Map of the United States, showing Waterways that Probably Could be Made Navigable for Commerce

While no survey and estimate of the cost of such a system has been made, there is good reason to believe, from the experience of Europe, that these rivers could be made navigable for about one-fifth what it would cost to build railroads affording equal accommodations for traffic

A View of the Chicago Drainage Canal

This canal has been built by the city of Chicago at an expense of over $50,000,000. It extends from the mouth of Chicago River to within sight of Joliet Lake, below Lockport. It can be navigated the entire distance of 36 miles by ships drawing 20 feet. The city has offered to contribute this magnificent waterway to the Gulf-to-Chicago deep-water route, provided the government will make a 14-foot channel in the Illinois River to Saint Louis. Army engineers have reported that such a channel could be constructed for $31,000,000, but Congress, before making this appropriation, has instructed the Mississippi River Commission to make a survey and estimate of cost for continuing the channel from Saint Louis to the Gulf. This picture shows a section of the Chicago Drainage Canal cut through solid rock. The stone is now being sold at a good price by the city.

Photos from *The World Today*

The Chicago Drainage Canal at Romeo, Showing the Great Two-mile Curve

Photo from Dr H. C. Frankenfield, U. S. Weather Bureau

Repairing a Levee at Lagrange, Mississippi

THE DEEP-WATER ROUTE FROM CHICAGO TO THE GULF

THE energetic demands of the Mississippi Valley for a deep-water route from the Great Lakes to the Gulf are not fully appreciated by other sections of the country. The hundred and more millions of dollars that may be required to construct and maintain a 14-foot channel from the Gulf to Chicago, up a river famous for its floods and shifting mud banks, make the plan seem extravagant and visionary to those not acquainted with the situation. But that the Middle West is in earnest is shown by the fact that the people of Chicago are willing to contribute to the water route a canal on which they have expended over $50,000,000. The national government has been very successful in its work in "reclaiming the West" by irrigation, in "saving the forests" by forest reserves and a capable forest service, in promoting our fisheries by distributing billions of eggs and fish annually, and it is now asserted, inasmuch as our inland commerce has far outstripped the railways, that the government should make our rivers useful.

Nature has favored no portion of the world with such a magnificent system of waterways as it has bestowed on the Mississippi Valley. The Mississippi and its great feeders, the Arkansas, the Missouri, the Illinois, the Ohio, the Tennessee, etc., offer nearly 15,000 miles of splendid river highways, but as yet commerce has made comparatively little use of them.

THE GARDEN SPOT OF THE AMERICAN CONTINENT

Twenty-two states are included in the Mississippi basin. They comprise 40 per cent of the total area of our country, and produce 75 per cent of all our exports. They furnish the great bulk of our agricultural products, about two-thirds of our manufacturing industries, and about $10,000,000,000 worth of finished products each year.

"The Mississippi River, with its tributaries, from its headwaters to the Gulf, embraces within its territory a constellation of states which, for wealth, mineral resources, agricultural products, soil, and climate, is not excelled by any other like group of states within our domain. The Mississippi Valley can, under proper conditions and culture, furnish the grain, the meats, and the fruits for the average consumption of the people of the civilized world. Her resources in minerals are but slightly developed, and, so far as known, are practically inexhaustible. Her people are healthy, educated, robust, energetic, and capable of accomplishing anything to which they may turn their hand or direct the energy of their body or brain."

Until recent years railways had been built fast enough to take care of the tremendous traffic in this region, but the extraordinary development of the past ten years, the growth of business between the North and South, and the increasing tendency of much of our commerce to seek an outlet from the Gulf, instead of on the Atlantic, has brought about an unsatisfactory situation. The railways cannot carry quickly and satisfactorily all the freight offered. More additional railway mileage is required than can be built, and the railways which have usually opposed the development of our waterways are now among the most earnest advocates of river improvements.

Parts of a statement on this subject by Mr James J. Hill, read in the House of Representatives during the last session, are given below.

"The business of the United States is today so congested that from every portion of the country arises clamor for relief. The railroads everywhere are taxed beyond their power. The people

of the United States, therefore, are face to face with the greatest business problem that has ever threatened the nation.

The following figures, compiled from the official reports of the Interstate Commerce Commission, and covering the growth of the railroad business for the last ten years, exhibit the significant facts:

	1895	1905	Increase per cent
Total single-track mileage	180,657	218,101	21
Locomotives	35,699	48,357	35
Passenger cars	33,112	40,713	23
Freight cars	1,196,119	1,731,409	45
Passenger mileage	12,188,446,271	23,800,149,436	95
Freight ton mileage	85,227,515,891	186,463,109 510	118

Within the last ten years the volume of railroad business in this country has increased over 110 per cent. Meanwhile the railroads have endeavored to meet it; while the increase in locomotives has been 35 per cent in number, and in freight cars of all classes 45 per cent, the substitution of larger cars for smaller, better methods of loading, and increase in weight of locomotives have greatly added to the carrying capacity of the railroads so far as rolling stock is concerned. There are and will be cars enough to carry the country's traffic if the cars can be moved, but engines and cars must have tracks upon which they may run.

A striking tale is told by the statistics of railroad building in the United States. Not only is it true, as stated above, that there has been in the ten years ending in 1904 an increase of but 21 per cent in mileage, but the most impressive fact is that railroad building has, within a generation, fallen off just as the demand upon trackage has increased. At this moment, when that demand is greatest and the whole country is clamoring for relief, it is the smallest in years. These are the figures:

	Total mileage	Increase		Increase per annum
		Amount	Per cent	per cent
1870	52,398	.....	.....	.....
1880	93,671	40,773	77	7.7
1900	163,597	69,926	74.6	7.46
1904	213,904	50,307	30 75	2.19
1906 (estimated)	220,000	6,250	2.9	1.45

The disparity between the growth of traffic and the additions to railroad mileage and the extension of terminals, shown by new mileage of less than 1½ per cent a year since 1904, to take care of a traffic increase averaging 11 per cent a year for ten years past, presents and explains the real problem.

The best judgment of many conservative railroad men in the country is that an immediate addition of not less than 5 per cent per annum to the railroad trackage of the country for say five years should be made to relieve the situation, and put an end to unreasonable delay in the transaction of business.

In order to handle the enormous addition of 110 per cent in business with only 21 per cent more track the railroads have utilized, as never before, the carrying capacity of each mile. Not only were there 35 per cent more locomotives and 45 per cent more cars in service in 1905 than in 1895, but each engine and car did much more work. The passenger miles traveled per locomotive increased from 1,218,967 to 2,043,553, or more than 68 per cent, the ton miles per freight locomotive from 4,258,821 to 6,690,700, or more than 57 per cent. Trains run faster, cars are larger, locomotives are more powerful, and methods of handling the business have so improved as to increase the general efficiency. Only by these improvements has the disparity between trackage and business done been prevented thus far from creating widespread suffering and loss.

No addition to equipment and no increased efficiency in operation can take the place of the imperatively required

new trackage and terminal facilities. Suppose that only 25 per cent additional tracks, with necessary terminals and equipment, is to be built during the next five years, for with less the country cannot conduct properly the volume of business even now in sight. Our total railroad mileage is about 220,000 miles. A 25 per cent increase would mean the building of 55,000 miles of new track, much of which would be additional tracks to existing lines; and if five years were allowed for the work, it would be necessary to build 11,000 miles each year. But that is not all. One-third would have to be added to this amount for terminal and passing tracks. Add 33 per cent to 55,000 miles, and the total is 73,333 miles; or, in round numbers, 75,000 miles of track as the requirement for the country to meet immediate needs. As most of these additional tracks would be built where traffic is heaviest, for double-tracking existing lines, it must be expensive work. Grades should be lowered, curvature reduced, and highway and the other bridges built and expensive terminals created.

No practical man would accept a contract for furnishing the facilities required, including additional equipments and terminal facilities, for less than $75,000 per mile. The question of terminals alone is most prohibitive. Terminals now in use were acquired when property was cheap, and can be enlarged only by heavy outlay. In many cities it is not even a question of cost, since the area necessary to handle railroad business properly is not to be had at any price, and does not exist within the business section where terminals must be located, unless the business itself were destroyed to make room. The new work, then, would amount to $5,500,000,000 in round numbers, or a yearly average of $1,100,000,000. This is the sum which should be spent before the commerce of the country can be moved properly. It is just twice the total amount of the bonded debt of the United States after the close of the civil war. It is more than twice the entire currency in circulation in the country, and only a little less than twice the deposits in all the savings banks in the United States put together.

A fifteen-foot canal or channel from Saint Louis to New Orleans would go further to relieve the entire Middle West and Southwest than any other work that could be undertaken. With such a depth of water a single powerful towboat would carry from thirty to forty train-loads.

POTENTIAL GREAT RIVER HIGHWAYS OF AMERICA *

This idea of connecting the Lakes with the Mississippi River and the Gulf is one of the greatest and widest conceptions of the age, fully as important, in my judgment, to the American people as the Panama Canal itself, and I earnestly hope that the Commission of Engineers created by this bill to survey that part of the route south of Saint Louis will encounter no insurmountable difficulties.

If Mr Hill is right, and deep rivers are needed to relieve freight congestion, why not improve the great Missouri River, which the engineers tell us is navigable up to Fort Benton, Montana, 2,285 miles from its mouth, thereby relieving the appalling congestion in North Dakota and Montana which now exists, and carrying invaluable benefits to all the citizens of its imperial valley? Why not give the Upper Mississippi at least six feet of water up to Mr Hill's home in Saint Paul? If Mr Hill is right about the Lower Mississippi, would not the situation be relieved by improving the Ohio River to a depth of nine feet from Pittsburg to Cairo—a distance of 1,000 miles to the greatest freight-producing section of the Union and the most populous and prosperous river valley on our continent? Why would not the congestion in Tennessee and northern Alabama be relieved by improving the Cumberland and Tennessee Rivers, which are splendid streams, susceptible to first-class naviga-

* Speech by Hon. Joseph E. Ransdell, of Louisiana, in the House of Representatives, January 31, 1907.

tion for many hundreds of miles? Why would it not relieve the congestion in the new state of Oklahoma, in Arkansas, in northern Texas, and Louisiana if we properly improved the Arkansas, the Red, and the Ouachita rivers? Why not help the people of Mississippi by improving the Yazoo and the Big Sunflower; those of Alabama and Georgia by deepening the Black Warrior and the Chattahoochee; those of Texas by canalizing the Brazos and the Trinity; those in eastern Georgia and South Carolina by improvement on the Savannah and the Santee; those in North Carolina and Virginia by proper expenditures on the Cape Fear, the James, and the canal from Norfolk to Beaufort; those in Pennsylvania and New Jersey by improving the Allegheny, the Youghiogheny, the Delaware, and the Passaic; those in New York and the Eastern States by coöperating with the Empire State to make its great Erie Canal of the greatest utility, and by canalizing the Connecticut River?

Why not improve the mighty Columbia River of the West and give to the people of that vast region relief from their freight congestion? Why not canalize the beautiful and historic Willamette? Why not apply to Sacramento and San Joaquin the same policy of improvement which Mr Hill urges for the Mississippi? If it be the duty of Uncle Sam to improve the Mississippi—and I quite agree with Mr Hill that it is not only his duty, but the part of wisdom to do so—surely it is his duty to improve all of these other streams as well, together with the many others I have not mentioned. The people on their banks are his children and entitled to his aid and assistance just as much as those who live on the banks of the Mississippi, and they need relief from freight congestion just as much relatively as the people of the Mississippi Valley.

WILL IT PAY?

These improvements would pay better than any investment this government has ever made.

It is a fact established beyond dispute that water transportation costs on an average in this country only one-sixth as much as transportation by rail, and whenever waterways are thoroughly improved not only does a large quantity of freight move thereon at rates only one-sixth as high as those by rail, but the rates of competing railroads are very materially reduced, and for every dollar of the people's money invested by Congress annually in the improvement of our waterways at least $2 a year are saved for the people in reduced rates.

The most striking instance of water transportation in this country on which we have accurate statistics is that through the Sault Ste. Marie Canal between Lake Superior and Lake Huron. According to Col. Charles E. L. B. Davis, United States engineer in charge of the work at that place, the total commerce passing through the locks in 1905 was 44,270,680 tons, which was carried an average distance of 833.3 miles at a cost per ton per mile of 0.85 of a mill, making a total of $31,420,584. It is estimated that the freight passing through the "Soo" during the year of 1906 was over 52,000,000 tons, but I have no accurate statistics thereon. The average freight charge per ton per mile on the railroads of the Union during 1905 was 7.6, which is about nine times as great as the rate on the Lakes. Now, if we assume that this great freight of 44,270,000 tons had been carried, not at the average rail rate of 7.6 mills per mile, but at 5.1 mills, which is six times the water rate, the freight charge thereon would have been more than $187,000,000, instead of the price actually paid, which was $31,000,000. Hence the saving on that amount of freight was about $156,000,000. It should be borne in mind also that there is a vast commerce on the Lakes which does not pass through the "Soo," and it is all moved at rates relatively the same, or 0.85 of one mill per ton per mile. The total cost of improvements on the Lakes is about $70,000,000, and the saving on the commerce through the "Soo" alone

in one year (1905) was nearly two and a half times as much as this total cost of all our improvements on the entire Lake System. Surely that was a wise expenditure of money.

Let me cite another instance of lake and rail rates. Between Pittsburg and the harbors of Conneaut and Ashtabula, on Lake Erie, there is a very large commerce, amounting annually to about 30,000,000 tons, composed of iron ore and coal. The ore is carried by boat from Duluth, at the head of Lake Superior, to Ashtabula or Conneaut, a distance of about 1,000 miles, and a charge of approximately 80 cents per ton. It is then loaded on cars and carried 135 miles to Pittsburg for 90 cents per ton, the rate being 10 cents higher to go 135 miles by rail than 1,000 miles by water, and the water rate being about one-seventh of the rail rate. Coal is carried from Pittsburg to these Erie ports at 90 cents per ton and loaded on boats for shipment to Duluth and other points on the Lakes, where it is hauled at the rate of 35 cents per ton, the water rate at this instance being one-twentieth of the rail rate.

THE OHIO RIVER

There is a very large commerce on the Ohio River, according to the report of the Ohio River Board of United States Engineers. The exact cost of carrying this commerce is not stated by the board, but one of its members, Maj. William L. Siebert, of Pittsburg, who is one of the ablest engineers in the corps, estimates that the cost of conveying freight on the Ohio River between Pittsburg and Louisville in 1905, even in the present unsatisfactory condition of the river, when boats are able only to operate a few months of each year, was 0.76 of one mill per ton per mile, one-tenth of the average rail rate, and that the cost between Louisville and New Orleans was 0.67 of one mill per ton per mile, about one-eleventh of the average rail rate. Hence we have the rate on the Lakes 0.85 of one mill, or one-ninth of the rail rate; on the Ohio, 0.76 of one mill, or one-tenth of that by rail, and on the lower Ohio and Mississippi, between Cairo, 0.67 of one mill, or one-eleventh of average rail rate, which is 7.6 mills per ton per mile.

This same Ohio River Board, in their report on the project for 9-foot navigation between Pittsburg and Cairo, estimate that with the Ohio River improved to that depth the freight charge between Pittsburg and Louisville would be 0.5 of one mill per ton per mile, and between Pittsburg and New Orleans 0.37 of one mill per ton per mile. They quote from an interesting report of Major Mahan, of the Engineer Corps, showing that the Volga River, in Russia, has an annual commerce of about 14,000,000 tons; that the navigation is about six months of each year; that the freight charge on cereals is 2.22 mills per ton per mile; on manufactured iron, 1.8 mills; on steel, 1.6 mills, and on naptha, 1.5 mills. They show, too, that the navigation is nearly all done against the strong current of the river, where it is much more difficult and expensive than slack water.

As an argument for the adoption of the 9-foot project they say that the steamer *Sprague* tows to market, from Louisville to New Orleans, sometimes as much as 60,000 tons of freight on one trip. The *Kaiserin Augusta Victoria,* one of the largest ships afloat, has a freight tonnage of 25,000 tons. The horse-power of the *Sprague* is 2,175; that of the *Kaiserin Augusta Victoria* 17,200, and that of sufficient locomotives to haul the *Sprague's* cargo on an average grade road, 24,000.

THE WATERWAY SYSTEM OF GERMANY

A study of the waterway system of Germany, in a recent excellent work on Modern Germany, by O. Eltsbacher, discloses the fact that Germany has developed its waterways to the highest degree, and immense quantities of freight are carried thereon. On the Oder the cost is about 3 1-3 mills per ton per mile; on the Elbe, 2½ mills; on the Rhine, 1.8 mills.

Among other things he says:

"Recognizing the importance of cheap transport and of an alternative transport system which would bring with it wholesome competition, Germany has steadily extended, enlarged, and improved her waterways, both natural and artificial, and keeps on extending and improving them year by year; and if a man would devote some years solely to the study of German waterways and make the necessary but very extensive and exceedingly laborious calculations, he would probably be able to prove that Germany's industrial success is due chiefly to cheap transport and the wise development of her waterways."

France, Holland, and Belgium have improved their waterways quite as thoroughly as Germany. It is said that freight can be moved from practically any part of these four countries, without breaking bulk, to any other part.

COST AND PROBLEMS TO BE MET

The preceding quotations from Mr Hill and Representative Ransdell, describing the situation in the Mississippi Valley, explain why the people demand a deep waterway from the Gulf to the Great Lakes, to be followed by deepening to a commercial depth all the principal tributaries of the Mississippi. No estimate of the cost of the deep waterway has yet been prepared, but it will considerably exceed $100,000,000. A board of government engineers in 1904 reported that to deepen the Mississippi and Illinois Rivers from Saint Louis to the terminal of the Chicago Drainage Canal would cost $31,000,000. This part of the project is comparatively simple. The route below Saint Louis, however, presents many difficult problems. The channel below Saint Louis is supposed to have a depth of 8 to 9 feet, but it is constantly shifting. The river frequently deposits as much as 15 feet of silt in one place in a single year, and then may carry it away in a week or less. Dredging in such places is of course useless. Competent geologists have estimated that the Mississippi River brings down 400,000,000 tons of sediment each year. From Cairo to the Gulf the river flows in a channel on the summit of a ridge which it has built up by its deposits. In this section vast and expensive levees keep the river from overflowing its banks and flooding the lower lands adjacent.

But while the difficulties of constructing a deep waterway surpass the problems presented by the Panama Canal, they are probably not insurmountable.

Many millions of dollars have already been expended on the Mississippi by state and national governments, but the results of the expenditure have been unsatisfactory, as no continuous and definite plan has been pursued, the national appropriations being irregular and uncertain. The last Congress made an appropriation for a careful examination and report by the Mississippi River Commission of the feasibility and cost of a deep waterway from the Gulf to Saint Louis. It is to be hoped that the Commission will be able to submit a comprehensive and practicable scheme, for, as President Roosevelt says in a recent address:

"The valley of the Mississippi is politically and commercially more important than any other valley on the face of the globe. Here, more than anywhere else, will be determined the future of the United States, and, indeed, of the whole western world; and the type of civilization reached in this mighty valley, in this vast stretch of country lying between the Alleghenies and the Rockies, the Great Lakes and the Gulf, will largely fix the type of civilization for the whole western hemisphere."

TRAFFIC ON THE MISSISSIPPI

Forty years ago the Mississippi and its tributaries were used for traffic much more than they are today. This traffic reached its height about 1870. During those years many handsome steamers of small draught plied up and down the river, affording a popular route to travelers from city to city. In the years following railways were built very rapidly, and as there was not enough business for both river and railway, the river com-

merce suffered. Some very interesting figures have been recently published by the United States Bureau of the Census comparing the river traffic of 1906 and 1889. While every line of business in the Mississippi Valley has increased enormously during this period, the commerce on our waterways has actually diminished.

The statistics represent all craft of 5 tons and over operating on the Mississippi River and its tributaries, chief among which are the Red River, Ouachita River, Arkansas River, Black River, Ohio River, Tennessee River, Cumberland River, Wabash River, Green River, Kanawha River, Monongahela River, Allegheny River, Missouri River, Illinois River, and the Saint Croix River.

	1906	1889
Number of vessels	9,698	7,300
Gross tonnage	4,530,276	3,364,610
Commercial valuation	$23,545,342	$14,407,162
Gross income	$17,611,555	$16,331,872
Average number of employees on vessels	15,342	15,951
Total wages paid	$5,805,807	$5,337,185
Number of passengers carried	13,691,956	10,858,894
Quantity of freight handled (net tons)	20,849,602	28,289,503

THE MARVELOUS PROSPERITY OF THE SOUTH *

In six years, 1900-1906, with an increase in the population of about 2,400,000, or something more than 10 per cent, the South has increased the value of its farm products by $728,000,000, or 57 per cent, and the value of its manufactures $761,000,000, or 52 per cent. It has added 3,493,000 spindles to its cotton-mill outfit, an increase of 55 per cent, and its mills used in 1906 about 2,375,000 bales of American cotton, or 48 per cent more than 1900. In the six years the South's annual pig-iron production has increased by 896,000 tons, or 34 per cent; its coal production by 34,202,000 tons, or 69 per cent; the value of exports at its ports, $177,000,000, or 38 per cent, though it furnishes more merchandise for export than it handles through its own ports, and in that time its railroad mileage has increased by 11,441, or nearly 22 per cent, and the assessed value of property by $2,490,000,000, or nearly 48 per cent.

With all this money-making going on, it is not surprising that the South is spending millions of money for improvements of many kinds. Counties are building better roads, better bridges, and better school-houses. Municipalities are erecting modern public buildings, installing water-works and sewerage systems, and using up-to-date methods and materials in improving streets. Railroad operations are double-tracking their old lines and extending new ones, are building handsome passenger stations, increasing terminal facilities, and adding to rolling stock. Individuals are devoting their earnings to improving their homes in town or country, or in building new ones, in enlarging barns, in buying stock, farm implements and machinery, in installing fencing, and in adding to the machinery for manufacturing. These investments are likely to increase during the present year and to keep pace with the increasing earning capacity of the South. They are some of the manifestations of a prosperity that is adding every day of the year about $7,300,000 to the wealth of the South, and which has brought that wealth close to $20,000,000,000.

During 1906 the wealth of the South increased $7,300,000 for every day of the year, Sundays included, or a total of $2,690,000,000. The actual increase in assessed value was $1,076,479,788, and this was on the average 40 per cent of the true value. The amazing magnitude of this gain of $7,300,000 a day is strikingly shown by the statement of the London *Express,* which, bemoaning the inability of Great Britain to keep pace with America's growth, put the increase in Great Britain's wealth at $7,000,000 a week. Contrast the South's increase of $7,300,000 a day with Great Britain's $7,000,000 a week, and then think of the future.

* Extract from the *Manufacturers' Record.*

NEW TOPOGRAPHIC MAPS

THE topographic maps recently issued by the United States Geological Survey cover the following areas:

State.	Quadrangle.
Arizona	Sacaton
Alabama	Birmingham (resurvey)
California	Holtville
Do.	Olancha
Do.	Tesla
Do.	Yosemite Special
Georgia	Talbottom
Iowa	Des Moines
North Carolina–South Carolina	Saluda
North Dakota	Bismarck
Ohio	Blanchester
Do.	South Charleston
Do.	West Manchester
Pennsylvania	Millerstown
South Carolina	Sharon
South Dakota	Redwater
West Virginia	Ripley
Wyoming	Younts Peak

New editions of sheets covering the following areas have also been issued:

State.	Quadrangle.
California	Dardanelle
Do.	San Pedro
Do.	Southern California, Sheet No. 1
Maine	Bath
Maryland	Baltimore
New York	Pulaski
Do.	Pultneyville
New York–Connecticut	Millbrook
Oregon	Ashland
Virginia	Spottsylvania
West Virginia	Harpers Ferry

The topographic work of the Survey in California, Maine, Maryland, New York, North Carolina, Ohio, Oregon, Pennsylvania, and West Virginia is carried on in coöperation with the states.

The term "quadrangle," used in the above lists, is adopted to designate the unit of the survey, and represents an area of one-sixteenth, one-fourth, or one "square degree." Each quadrangle is named from some well-known place or feature located within it. Index maps showing the location of the quadrangles in relation to adjoining areas will be furnished on application.

The maps of these quadrangles, which are known as atlas sheets, are for sale by the Survey. Sheets of standard size are sold at the rate of 5 cents each, or 3 cents each in lots of 100 or more.

INTRODUCING REINDEER INTO LABRADOR

THE remarkable success of the United States government's experiments in importing domestic reindeer from Siberia into Alaska, which has enabled nearly 20,000 natives of northern Alaska to become self-supporting, has induced Dr Wilfred T. Grenfell, the medical missionary to the Labrador coast, to try the same experiment in Labrador. Dr Grenfell has recently purchased 300 reindeer in Norway, which will be carried across the ocean in a special steamer early in December. The reindeer are in charge of several Laplanders, and will be distributed in herds along the Labrador coast. The rapid extermination of game in Labrador has made Dr Grenfell realize that in a few years the Eskimos and natives of Labrador will die of starvation or become dependent on bounty unless a new food supply is found for them. He hopes that the natives of Labrador, like the Alaskan natives, will soon have herds of domestic reindeer to furnish them with food, clothing, and utensils.

It is now nearly 20 years since Dr Sheldon Jackson, of the United States Bureau of Education, recommended and obtained from Congress an appropriation to import reindeer from Siberia across the Bering Strait. During the first year 16 deer were brought over by Dr Jackson personally. During successive years there were imported others until their number reached a thousand. There are today no less than 16,000 domestic reindeer distributed in herds along the north Alaskan coast. Large numbers of them belong to the mission stations, giving employment to the natives in the vicinity, while a considerable number of the Eskimos possess herds of their own.* The United States government loans its reindeer to worthy natives or mission stations for a term of years. Dr Grenfell has modeled his program after the plan so successfully followed by the United States government under the direction of Dr Jackson.

*See "Reindeer in Alaska", NAT. GEOG. MAG., April, 1903.

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THE NATIONAL GEOGRAPHIC MAGAZINE

QUEER METHODS OF TRAVEL IN CURIOUS CORNERS OF THE WORLD

By Hon. O. P. Austin

Chief U. S. Bureau of Statistics

NO feature of tropical or oriental life more impresses the traveler from the temperate zone occident than the methods of travel and transportation which greet him at every hand. Whether it be upon the mountains or tablelands of Mexico and Central America, the cordilleras or plateaus of South America, the islands of the Caribbean, the deserts or jungles of Africa, the sandy wastes of Arabia and the Holy Land, the densely populated plains of India, the mountain passes of Tibet, the jungles of Siam, the islands and watercourses of the Philippines, the crowded cities and highways of China, the rugged hills and narrow valleys of Korea, or the coastal cities and mountainous interior of Japan, the methods by which man travels and man's requirements are transported are ever strange, ever changing, ever fascinating. To the man or woman who has been accustomed to travel by the comfortable methods of our own country a marked contrast is found in the burro of Mexico, the llama of South America, the sledges of Madeira, the saddle ox of Central Africa, the camel of the desert, the donkey of North Africa and Arabia, the bullock cart and the "dandy" of India, the yak of Tibet, the trotting ox of Ceylon, the elephant of Siam, the carabao of the Philippines, the wheelbarrow and sedan chair of China, the pack bull and palanquin of Korea, and the jinricksha and kago of Japan. From the moment the traveler leaves the temperate zone countries of the occident and plunges into the tropics of the orient he finds as a poor substitute for that noble animal, the horse, the donkey, the llama, the camel, the elephant, the ox, the carabao, and, finally, man, in those densely populated sections where labor is cheap and land cannot be spared to support animals for transportation.

Of the 100 million horses known to exist in the world, 80 millions, or four-fifths of the entire number, are found in the temperate zone and nearly all among occidental people, while the remaining 20 millions, scattered through the tropics, are largely employed in the service of temperate-zone visitors or residents, and are but feeble representatives of that animal as he is known to the people of Europe or America.

In the United States and Canada we

* Notes from an address to the National Geographic Society, 1907

The "Burro" or Donkey of Spanish America

have 1 horse for every 3½ persons; in South America, 1 for every 7; in Mexico, 1 for every 12; in Japan, 1 for every 33; in Turkey, 1 for every 40; in the Philippines, 1 for every 50; in Africa, approximately 1 for every 150; in India and Southern China, 1 for every 200.

The comparative absence of the horse in the tropics is due chiefly to climatic conditions, and in the orient to the fact that the density of population prohibits the utilization of land for the production of his food. In his place we have, therefore, scattered through the tropical and oriental countries of the world, approximately 3 million camels, 10 million donkeys, and 20 million buffaloes or caribao, and, everywhere that horses are not available, the patient, slow-moving ox.

The llama will carry from 50 to 200 pounds; a man, from 75 to 150 pounds; the donkey, 100 to 200 pounds; an ox, 150 to 200 pounds; a horse, from 200 to 250 pounds; the camel, from 350 to 500 pounds; the elephant, from 1,800 to 2,500 pounds.

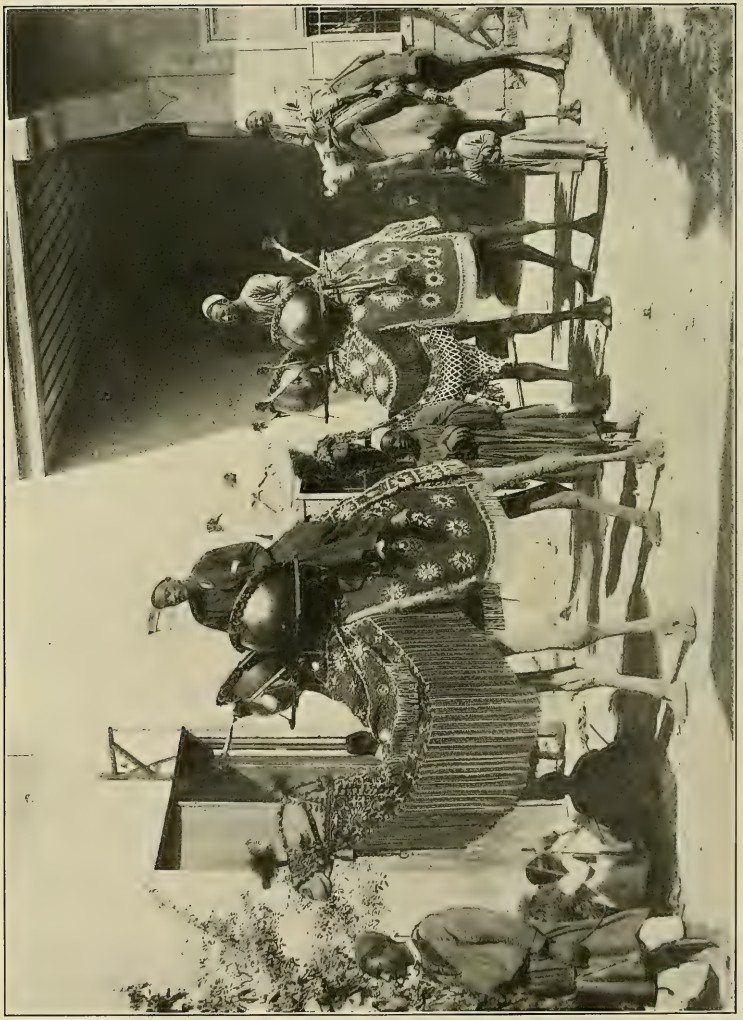
Photo and Copyright by Underwood & Underwood, New York

Camel Wagons at Delhi, India

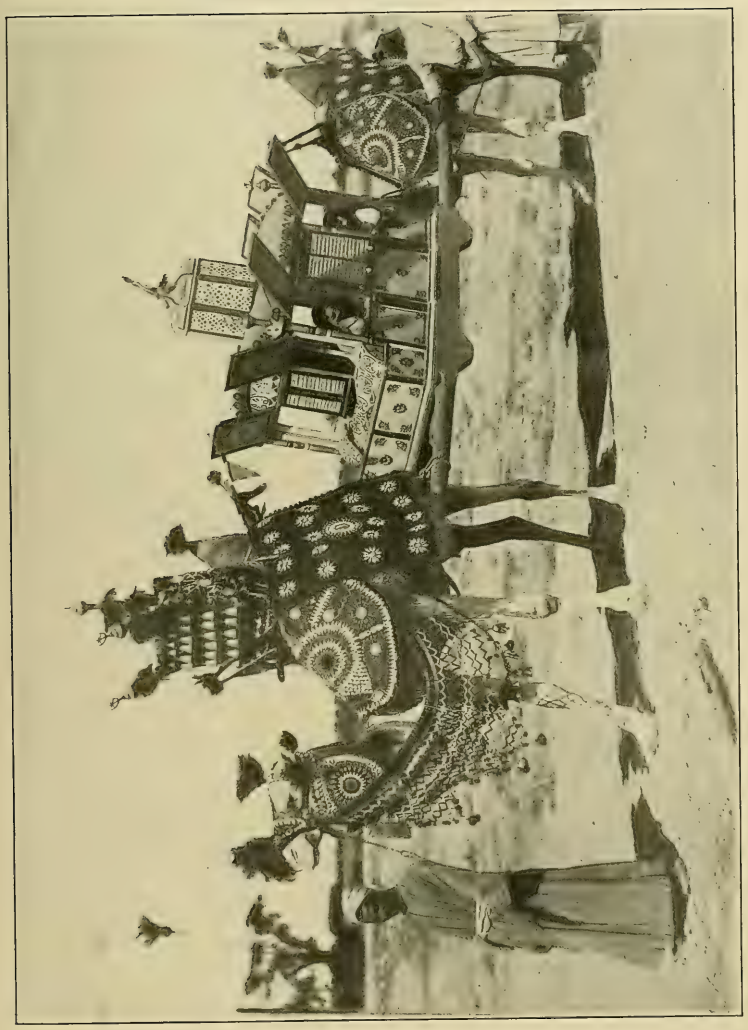
With the scarcity of animal power in the tropics and the orient, man has devised many methods for travel and transportation, and, in many cases, has, perforce, put his own shoulder to the wheel, or his own neck under the yoke, and made himself a burden-bearer and the transporter of not only merchandise, but, in some cases, of his fellow-man.

I confess to you that until I had visited these countries and seen these things with my own eyes I could scarcely realize that the conditions which I had seen pictured were those of the present day; but now that I have seen them in actual existence in this twentieth century, I begin to realize the great disadvantage under which tropical and oriental man has labored in his attempts to develop exploration, intercommunication, and exchange of products, and the great benefits to him, and to geography, to science, and to commerce which would come from some satisfactory device which would do for the tropics and the orient what the horse has done for the temperate zone occident.

Our line of march in observing these peculiar conditions will take us around the world, plunging first into the Spanish-American tropics, thence to Western and Northern Africa, thence for a short tour through Southern Europe, thence via the Holy Land to India, Tibet, the Malayan peninsula, Java, the Philippines, China,



Scene from a Wedding Procession, Cairo, Egypt



The Bride on Her Way to Her New Home, Cairo, Egypt

Photo by O. P. Austin

The Belgian Milk Wagon

Photo and Copyright by Underwood & Underwood, New York

Crossing a River in India on a Raft of Inflated Bullock Skins

Korea, Japan, and returning via Northeastern Siberia and our own Alaska.

At our very first stop in Mexico we encounter the "burro," the Spanish term for the animal which we usually know as the "donkey." The statistical records indicate the existence of about 10 million of these diminutive and patient burden-bearing animals scattered over the world, chiefly in Spanish America, Northern Africa, Arabia, and the Holy Land. Originally domesticated in the Holy Land and Egypt, he was carried to Northern Spain by the Mohammedans, and thence to America by the Spanish explorers and colonizers.

While much used in Spanish-American countries, he is less prized and less cared for than in his original home of Western Asia and Northern Africa, where he is the constant companion of man, returning a reasonable care with faithful service and evident affection for his master.

They are used not only on the mountain roads, where they are more sure-footed than the horse, but also in the towns and cities; the horse in these more populous centers being reserved for the transportation of people.

For transportation over the country roads or in the mountains they are assembled in considerable numbers and march singly, following their leader in a long file known as the "pack train."

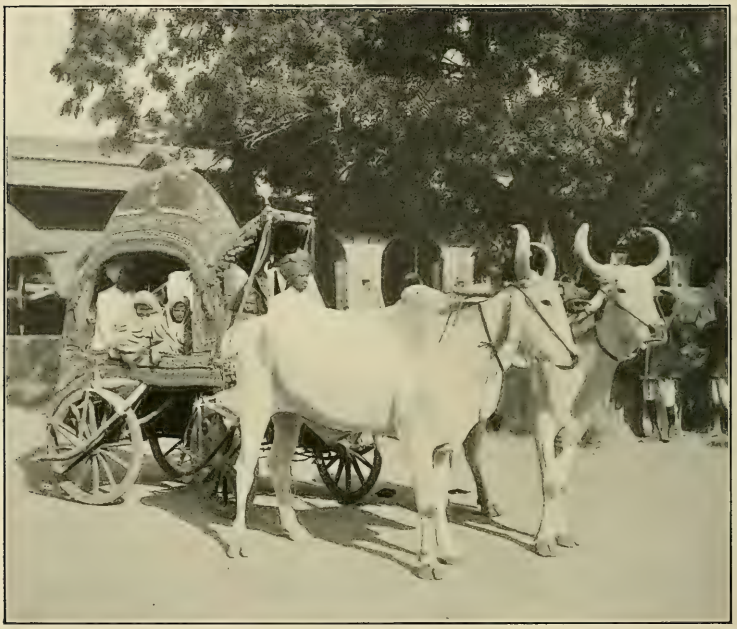


Photo by O. P. Austin

A Bullock Carriage Used by Ladies of Rank, India

They travel a distance of from 10 to 20 miles per day, according to conditions of roads, carrying loads of from 100 to 200 pounds each, and, accompanied by their masters in the curious costumes of Spanish America, present a picturesque appearance as they wind in long trains through the valleys filled with tropical verdure.

In many of the mountain sections these pack trains are the only methods yet available for the transportation of ore from the mines to the smelting works or the seaboard.

Further south, in the mountain ranges of South America, where the great altitude and difficult travelling requires an animal especially prepared by nature for these peculiar conditions, the llama is still used in limited numbers as a beast of burden. The llama was the only animal suited for transportation found in America by the Spanish discoverers and explorers; the horse, the donkey, and the ox, which now perform most of the work having been brought originally from Europe. The llama belongs to the camel family, having the same peculiar foot with a divided hoof and cushions placed on the under surface, thus making it especially valuable for mountain climbing and on sandy plains, and having also many of the peculiar habits which characterize the camel.

Photo and Copyright by Underwood & Underwood, New York

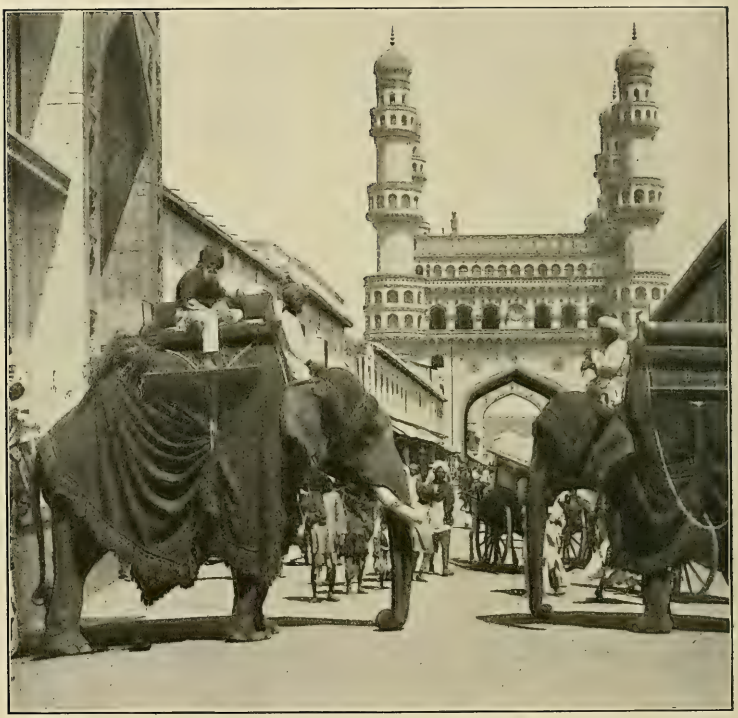
A Hill Country "Ekka" with Passenger and Baggage, India

In all parts of that great line of deserts, stretching from North Africa across Central Asia to Northwest China, the camel is everywhere in evidence; the total number in the world being estimated at about 3 millions.

Here, in the midst of these great waterless areas, we see the camel in all the varied types and in the variety of methods of his utilization. How valuable this strange and always weary-looking beast is to the people of North Africa and Central Asia can scarcely be realized until you see him, as I have, actually performing his service, and realize that he is the only beast of burden able to endure the long marches across the desert.

Costing about as much as a good horse, his speed is equally great, his life considerably longer, and his ability to carry a load equal to that of three horses, while the fact that he can travel for a week, or, if necessary, nearly two weeks without water renders him invaluable to those great sandy stretches. He can also go for several days with little or no food, subsisting meantime upon the fat stored in the humps on his back, which nature seems to have provided as a storehouse for sustenance in case of absence of food.

Not only is the camel a valuable freight carrier, but he serves as the travelling car of the Rockefellers, the Carnegies, the Morgans, and the Harrimans of the des-



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Conveyances in Hyderabad, India

ert. When he is chosen for this more pretentious service, a light framework is placed upon his back and covered with cloths to screen the occupants from the sun and the observation of the passers, and decorated with pompons of varied colors. In this gorgeous compartment, which may be not inaptly termed the "Palace Car of the Desert," the master of the camel train places his wife and children, his choicest merchandise, his cooking utensils, and daily requirements, and travels in state, the observed of all observers, the envy of the wandering native of the desert.

From Africa we pass to that curious section of Southwest France known as the "Landes," consisting of some 5,000 square miles of flat and sandy marshes. The inhabitants are chiefly engaged in cattle raising. The peculiar condition of the soil, composed chiefly of sand and marsh, makes travel by the usual process difficult, and so the shepherds go about on stilts.

In some parts of this formerly unin-

Photo and Copyright by Underwood & Underwood, New York

Morning Ride of a Lady of Calcutta in Her Palanquin

habitable region the lands are being rescued from the drifting sands by the planting of trees, and in other places are being developed by drainage; and so, while the number of inhabitants is increasing, the number of stilts required is growing less.

Of course, we could scarcely omit the Belgian dog cart in this discussion of queer transportation methods, for, while the use of the dog for labor is gradually being abandoned in most other countries, the Belgians still cling to the custom.

One of the queer transportation methods which modern civilization has furnished is the single-rail railway which runs from Elberfeld to Barmen, Germany, carrying its passengers and freight in cars, suspended from wheels which run

A "Push-Push" of India. Photo by Rev. T. S. Wyncoop, of Allahabad

A very common means of travel, the cart being pulled by men for hundreds of miles

on a single rail, supported by a framework, and operated by electricity generated many miles from the place at which it is applied to the propulsion of the cars.

Nor could we, in this discussion of queer transportation methods, pass Venice, that city without a single horse. I am not sure that this description of Venice as an *absolutely* horseless city is literally true, though I was solemnly assured while there that there was not a single horse in the city; but certainly there are but very few, if any, and the horse on their streets would be quite as great a novelty to the Venetians as a gondola on the Potomac would be to us in Washington.

In the Holy Land the donkey is in evidence everywhere and furnishes the chief method of transportation.

His availability for application to all kinds of transportation, whether for people or merchandise, coupled with his small cost and limited requirements for food, render him especially valuable to the people of this section.

We now bid adieu to the donkey and the camel and will review some other curious methods which still prevail on the rivers which flowed past the Garden of Eden. On the Euphrates and the Tigris are still retained the curious water transports of centuries ago—the raft of skins and the circular boats. These rafts are sustained by inflated skins, prepared for this especial purpose, and after the raft floats down the river to its destination the inflated skins are removed, the air permitted to escape, and the skins carefully folded and carried back to the upper waters, where they are again inflated and used as the support of another, and still another raft.

Even more curious, to the eyes of the traveler from other parts of the world, are the circular boats, made of wickerwork and covered with skins, or made water-tight with pitch, which are still in daily use on the Tigris and Euphrates Rivers. These curious little vessels are used for the transportation of both passengers and freight, and the skill with which they are managed by those accustomed to their use is quite surprising and interesting. Just how they get animals in and out of these courious vessels seems a little puzzling, though it is probably no more difficult than the methods by which cattle and horses are lifted from a lighter and deposited in the hold of the modern steel steamer.

No feature of life in India is more striking than that of the methods of transportation. From the moment you put foot on the land you find a bewildering variety of vehicles, most of them drawn by the humped ox, known in our zoölogical gardens and menageries as the "sacred ox."

The elephant is still used to some extent in India, Burmah, and Siam, though in these sections in which roads have been developed his place has been taken by the ox and other methods less expensive.

The large quantities of food required by the elephant make him available only in the comparatively undeveloped sections, where heavy work is required in handling timber, or in the military service. His ability to carry heavy loads, how-

Carts with Bamboo Covers, Ceylon. Photo by S. A. Knapp

Young Men Riding to a Mohammedan Festival Allahabad, India. Photo by Rev. T. S. Wyncoop

Coolies in the Himalaya Mountains Bringing Hay to Market. Photo by Rev. T. S. Wyncoop, Allahabad.

ever, still leads to his use in certain sections, for he can easily carry a ton at a single trip and maintain a speed of about four miles an hour in a climate in which horses are comparatively useless.

The method of conveyance by a pole supported on the shoulders of men is very common throughout India, and is known as the "dandy."

From India onward we find an increasing use of man for the transportation of both merchandise and people, due chiefly to the cheapness of labor and the density of population, which precludes the use of land for producing food for animals.

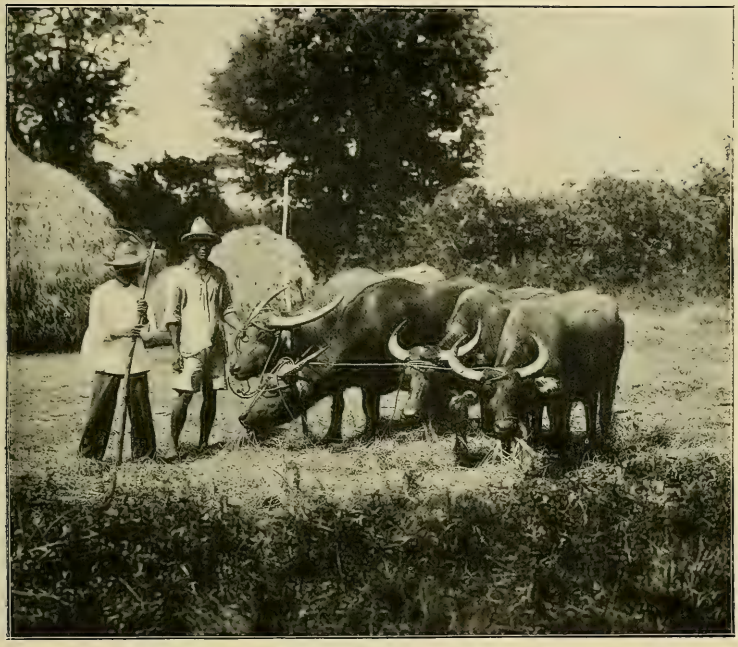
In Ceylon we get our first glimpse of the jinricksha, which competes with the famous trotting oxen of the island. The trotting ox is trained to fast traveling, and when attached to light carts and driven by experienced men makes a speed which is quite marvelous.

In Ceylon we also see for the first time the peculiar boat with outriggers, which is found in various forms among our Samoan, Philippine, and Hawaiian neighbors. The boat is very narrow, and is steadied by the long outrigger, to which is attached a pole, which rests on the surface of the water. I well remember my first experience in riding in one of these narrow boats from the dock at Colombo to the steamer lying off in the harbor, and I must admit that I had a better opinion of the boat and the boatman after this practical test than I had before.

Another type of boat in use in the Philippines has double outriggers, one set at each side. These boats are found in the waters of practically all parts of the Philippines and of our Pacific islands.

On page 701 is an illustration of that useful animal the carabao, or water buffalo, which forms so important a factor in the agriculture and transportation of the extreme Orient. Originating in India, the carabao has been transported westward as far as Egypt and eastward through the Malayan peninsula, China, Indo-China, and the islands of the Indian Archipelago. The number among the oriental people is estimated at fully 20 millions, and you will find them in greater or less numbers all the way from Egypt to China. Costing about one-half as much as an ordinary horse, they perform all the services usually required of that animal, and their extreme deliberation in movement is compensated for in the fact that they can endure the heat of the tropics, while their fondness for water and mud renders them especially useful in the flooded rice fields and on the muddy roads during the rainy season.

They are used in every way that the horse is used in the temperate zone; attached to sleds, to carts, to drays in the cities, to carriages, and as saddle animals. Their thick, brown skin, almost devoid of hair, gives little heed to the whip, yet they are docile, patient, friendly with the



Carabaos Threshing Rice in the Philippines

natives, but unfriendly to the white man, and of great service to the Filipino, both on the farms and the roads.

In the towns and cities you see them everywhere, drawing heavy loads on carts and drays, standing patiently in the broiling sun, if they can but have an opportunity once or twice a day to wallow in the water and mud of some nearby stream. Without an occasional opportunity to submerge themselves in water they soon become unmanageable and even dangerous to those about them.

While their chief service is for agricultural work and the hauling of heavy loads, they are sometimes attached to carriages, where horses or ponies are not available, and this is not infrequently the case, for the number of horses and ponies in the islands is but about 150,000, while the number of carabao is nearly one million. There is no "speed limit" for the carabao carriage.

One of the common methods of transporting water in the Philippines is given on page 703. The long bamboo pole carried on the shoulder of this girl is filled with water. The bamboo is prepared for this service by punching out the sheets of light material which divides it into sections at the joints.

In China we find less of animal transportation and much more performed by man power, and this is especially true of Southern and Central China. At the north, where the climate is that of the

Tagalog Boys Carrying Vegetables to Manila

temperate zone and the population less dense, there are horses, though in small numbers as compared with similar conditions in the occident. The street scenes on page 706 show the various methods utilized in the coast cities and the interior. We have here the jinricksha pulled by men, the wheelbarrow, and the coolie porter. The coolie porter is seen everywhere, carrying loads of from 150 to 200 pounds, divided between the two ends of the bamboo pole, stepping briskly along the street or road, chanting a curious sort of cry, which he imagines helps him to more readily endure the fatigue of his burden.

The three principal methods of transportation of people in Central and Southern China are the Sedan chair, the jinricksha, and the wheelbarrow. The Sedan chair gets its name from the fact that it is modeled after a type once used by the aristocracy of the city of Sedan, France. They are much used in Hongkong, because the steepness of the mountain side on which most of the foreign residents live make the use of the jinricksha extremely difficult. In the narrow streets of the native quarters of the great cities they are the only available method for transportation of people, except that of the wheelbarrow, and in the crowded sections it is only with the greatest difficulty and by the aid of the warning shouts of the bearers of the chair, or the runner who precedes them,

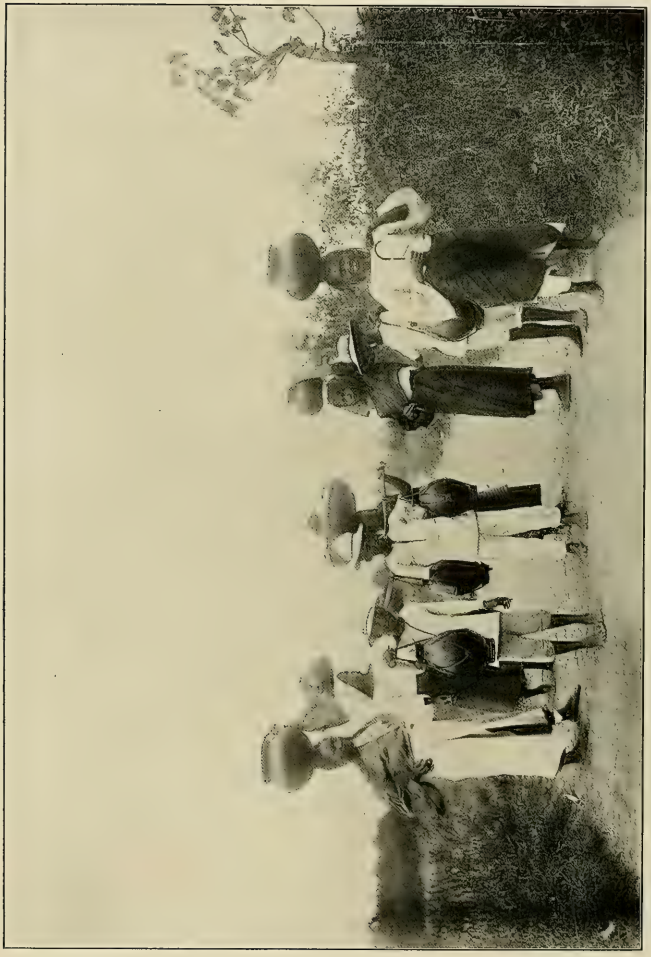
Photo and Copyright by Underwood & Underwood, New York

Carrying Water in Bamboo Tubes, Philippine Islands

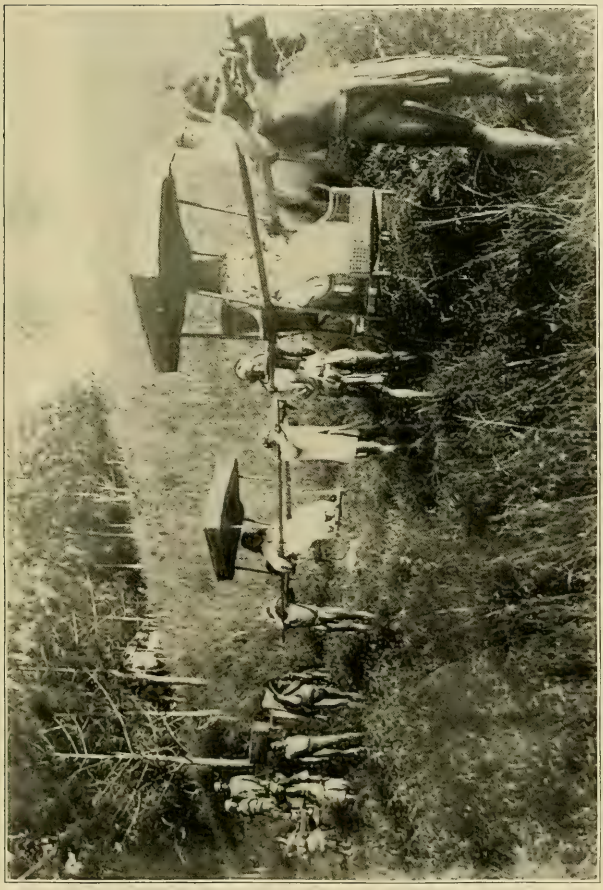
that the mass of humanity is induced to give space for its passage.

The more expensive type, and that most affected by the wealthy and exclusive of the Chinese, are enclosed with lattice work, and, while the open type is more convenient for sight-seeing, those having the screen at the sides and rear have their advantages in the crowded native quarters, since the occupant is partially screened from view and less liable to have his progress interrupted by the crowd of curious natives, which always gathers at the sight of an American or European traveler in the native quarters. Even in these, however, the traveler is not always free from observation, for it was while riding in a chair of this general type that the German Minister, Baron Von Kettler, was attacked and killed during the Boxer riots in Pekin.

The sensation of riding in a Sedan chair is not an especially agreeable one. It is placed on the ground for the passenger to enter, the coolies take their places at the end of the poles, and at a signal given by the man in the rear the chair is lifted until the poles rest on the shoulders of the men. Then they start off at a quick pace, winding their way through the crowds, jostling, shouting, halting, and again starting as the crowd gives way; and, unless they keep step, which they seldom do, the swaying, tee-



Carrying Milk to Manila



Traveling in Luzon, Philippine Islands

Wheelbarrow Carrying Freight and Passenger, Shanghai. Photo by O. P. Austin

that the wheel is set in the center and thus supports practically the entire load, while the handles are supported in part by a strap or rope over the shoulders of the man who operates it. As a result, the wheelbarrow coolie in China will transport nearly a half ton on his vehicle.

Wheelbarrows are much used in the country, where the roads are but little developed, and it is said that passengers sometimes make the entire trip from Shanghai to Pekin, a distance of 600 miles, by barrow. A two-passenger barrow will make about 20 miles per day, and the coolie is content with a pay of about 20 cents per day, or an average of about one-half a cent per mile for each passenger, or about one-fourth of the low passenger rate recently fixed for the railroads by several of the States of this country. Yet, I presume, most of us would prefer to pay the two-cent rate in a comfortable passenger coach

tering motion imparted to the chair by the long flexible poles on which it rests is anything but agreeable to the inexperienced.

Probably more freight and more passengers are transported in China by the wheelbarrow than by any other land method. The wheelbarrow there used differs from that used by us, in the fact

Street Scene in Hongkong. Photo by O. P. Austin

A Dray Seen on the Streets of Shanghai. Photo by O. P. Austin

than the one-half-cent rate on the wheelbarrow. On the level, well-kept streets of the foreign quarters of such cities as Hongkong, Shanghai, and Pekin, the wheelbarrow coolie will struggle along with a load of 6 or even 8 people.

Other strange methods of transportation in China are the junks, sampans, house-boats, and river crafts, which crowd the rivers, harbors, and canals of that densely populated empire. Many of them have peculiar marks, resembling an eye, painted on either side of their bows, which, I found on inquiry, were really intended to represent eyes, and are provided in the firm belief that they actually aid the vessel in finding its way.

The junks and sampans are the freight carriers along the coast and in the harbors.

House-boats are found everywhere, but especially in the waters adjacent to the great cities, and it is estimated that several millions of the people of China have no other home than these floating residences. They are supplied with the simple requirements for cooking and daily life of the home, the pig sty at the rear, the tiny flower garden at the front or upon the roof, and are often sculled from place to place by the mother, with her children playing about her and her youngest strapped upon her back. I have often seen these Chinese and Japanese boat women sculling their boats about the harbors, halting at the sides of vessels and clamoring for employment, meantime hushing the cries of the babies on their backs by a peculiar shuffling, swinging motion of the body as they scull the boat or shout their offers of service.

In Korea the bull, the donkey, and the chair coolie vie with each other as burden-bearers, though the donkey is more reserved for long distance travel in the mountainous regions. The chairs are not unlike the palanquin of India or the Sedan chair of China. In most cases they are carried by straps or ropes attached to the ends of poles and passing over the shoulders of the coolies.

Official chairs are usually carried by four and sometimes eight porters, and are by

Transportation by Man Power, Yokohama. Photo by O. P. Austin

far the most comfortable method of travel in Korea. A team of good coolies will take you over the country at the rate of four miles per hour, sixteen hours at a stretch, thus enabling you to make over 60 miles in a single day, provided you are willing to endure your share of the fatigue by sitting cross-legged in the box for that length of time.

Japan is said to be the home of the jinricksha, which it is claimed was invented by an ingenious American missionary. Whatever may be the true story of its nativity, it is no longer peculiar to that country, for you see it everywhere along the Asiatic coast, from Ceylon eastward to Vladivostok. While the jinricksha is the popular mode of conveyance in the coast cities and on the level country roads of Japan, it will not serve in the mountains, which abound in every part of the interior. There its place is taken by the "kago," which is quite similar to the "dandy" of India.

Even in the most occidental of all the oriental cities—Yokohoma—where contact with western methods has induced the adoption of many of our customs, man power is still the principal factor in transportation.

As we leave Japan our steamer must be again coaled, for Japan furnishes the chief coal supply of the orient at the present time. The coal is brought alongside the vessel in open barges; a series of platforms built out at the side of the vessel, each one about 4 feet higher and 3 feet narrower than the one next below, looking like a big flight of steps up the side of the vessel. Then a Japanese man or woman is stationed on each of these steps, and a lot of men and women in the barge below, and supplied with scores of small baskets, holding not to

exceed a half bushel each. These they fill with the coal, and they are passed by hand, one at a time, to the person stationed on the first of the platforms, and he passes them, one by one, up to the person on the platform next above him. Thus, hour after hour, a steady stream, or perhaps several streams, of these baskets flows up the side of the ship, passed from hand to hand, men and women working together indiscriminately and emptying barge after barge until the vessel has received its requisite supply. But it is a slow method at the best, and I well remember the experience of lying for two days in a broiling sun, just off Shimonesiki, waiting for a multitude of Japanese men and women to perform a service which might have been performed in an hour by the appliances in use in the United States. Here a great crane, operated by steam or electricity, picks up a car carrying perhaps 50 tons of coal and pours its contents gently into the hold of the steamer lying alongside.

The picture of the mail-carriers in Alaska (on page 710) illustrates the extent to which the reindeer has become a factor in the life of that section, due to the foresight and energy of Dr Sheldon Jackson.

And now, as we return home to our land of the horse, the trolley car, the railroad, and the horseless road vehicle, and contrast our own conditions of travel and transportation with those of the tropics and the orient, I want to suggest the possibility of the extension of certain of our transportation methods to those countries, and the development of prosperity which may result.

Clearly the conditions of transportation in the tropics and the orient are due, in part at least, to the absence of that noble animal which has so served us in the temperate-zone occident—the horse. He has rendered possible the development of Europe and America by transporting the product of the farm, the mine, and the factory to the common carriers—the ocean, the river, the canal, and the railway—and to the sections thus developed has come great prosperity. In the tropics, where the horse cannot endure the climate, and in the densely populated orient, where land cannot be spared to supply him with food, the facilities for transportation to a common carrier are inadequate; the common carrier is therefore not provided, and there is sluggishness, lack of production for exchange, lack of commerce, lack of prosperity. True, rivers do exist in those countries, and railroads can be built; but if they lack some satisfactory means of transporting the natural products from the place of production to that common carrier, the carrier will not be supplied, the farm will not be developed, the mine will not be opened, the factory will not be built, and that prosperity which comes from a ready market for products cannot prevail. As a result, the horseless areas of the world have remained undeveloped and unprosperous, while the area supplied with the horse has developed and become extremely prosperous.

Now comes the final question, whether the ingenuity of man has provided any substitute for the horse, which can be utilized in those areas where the horse cannot exist because of climatic conditions or lack of space for the production of his food. To this question I think I may answer in the affirmative. For many years man has been experimenting in attempts to transport merchandise and men by some machine which carries within itself its own propelling power. He learned a century ago that he could do this on the water by the steamship. Then he soon learned that he could drive a wheeled vehicle on land by power produced within itself, provided he supplied it with an iron or steel track on which its wheels might run, and with this knowledge the railroads spread over all of that part of the world where horses could be found to bring the product to their stations.

But until the beginning of the twentieth century man had not solved the problem of operating self-propelling vehicles on ordinary dirt roads or across stretches of

Reindeer Carrying U. S. Mail, Alaska. Photo from Wm. Hamilton, Bureau of Education

country in which no roads exist; but that art has at last been attained. The introduction of the bicycle brought the rubber tire, and the application of the rubber tire brought a self-propelled vehicle which could be operated on country roads—the automobile. Then came the development of the freight motor, which would carry heavy loads of merchandise over the ordinary highways and even over sections where no roads exist, and today thousands of horseless vehicles are moving hundreds of thousands of tons of merchandise over roads of a type which can be supplied everywhere, in the tropics or the orient, as well as in the temperate zone or the occident.

AUTO TRUCKS

The possibility and practicability of applying the self-propelling vehicle to the transportation of merchandise and people in deserts, in the tropics, and the orient has already suggested itself, and the experiments made have already assured success.

In the deserts of New Mexico and Arizona motors are successfully carrying freights in a temperature of from 120° to 140° in the sun, where, owing to the extreme heat, horses or mules can only be used at night. In Nevada a single motor truck is now performing the work of 30 horses, carrying freight over 100 miles of mountain roads. In California a train of motor cars is carrying over dirt roads in the mountain regions as much ore at each trip as would require 200 pack horses for its transportation. In Porto Rico a line of three motor vehicles, established to carry passengers and mails, performs the work for which more than a score of vehicles and over 100 horses had been required. Numbers of American motor vehicles for carrying heavy loads have been put on the roads of Cuba and Santo Domingo with success, and more are being ordered. In Honduras motor trucks are conveying minerals to the seaboard from the mines 100 miles inland, a single motor performing in one day as much work as could be performed by 100 mules in the same time.

In South America the horseless vehicle is carrying passengers and freights to the inland cities over roads where only the donkey was utilized, and doing so at an enormous saving of time and expense.

In Egypt the freight and passenger motor is beginning to take the place of the camel; hundreds of horseless vehicles are in operation, some of them over long stretches of desert, and roads are being constructed through the desert, on which the product of certain mines will be brought to market. In Turkey motor cars are making regular trips over country roads, carrying both freight and passengers. In India motor cars are being imported at the rate of nearly two million dollars' worth per annum, and put

Photo and Copyright by Underwood & Underwood, New York

Crossing the Thelmu River by a Bridge of One Rawhide Rope, Uri, India

in service on the country roads as well as in the cities and towns; a company has been organized to manufacture motor cars, and our Consul General reports that the Indian government is considering the desirability of utilizing motor transport wagons for moving the products of the out-of-the-way districts to market. Special Agent Crist reports to the Department of Commerce and Labor a rapidly increasing use of the horseless vehicle in South Africa, especially in the mining regions; that trains of freight wagons are now being hauled by steam motors over stretches of country where no roads exist, and that the cost of constructing motor roads where they are required is only about one-eighth as much as that of railroads. In the Kongo the Belgian government is constructing hundreds of miles of road, for the use of the motor, which is to be applied to the transportation of freights.

In Java an American horseless vehicle is now being used for the transportation of mails over the country roads. In Japan the experiments with the horseless vehicles have been so successful that a company has recently been organized to build and operate horseless vehicles for a

Photo from David Fairchild, U. S. Dep't of Agriculture

A Carriage in Madeira, where all Conveyances are Sleds

general transportation service to Tokyo and thence to the surrounding towns. In the Philippines a line of motors is about being put in to carry passengers on certain country roads, pending the completion of the railway, for which contracts have recently been let.

A special type of vehicle, made in Paris, has now trains of horseless freight and passenger trucks operating in France, Belgium, Germany, Turkey, Servia, Bulgaria, Algeria, Central Africa, Chile, and Peru.

And, finally, so confident are those acquainted with the horseless vehicle and its ability to operate in the tropics and the orient, that a race of motor vehicles from Pekin, China, to Paris, France, a distance of 9,000 miles across the desert and through countries in which the camel is now the chief carrier, has actually taken place, more than a score of vehicles having entered the race.

Horseless vehicles may be operated by steam, by gasoline, by alcohol, or by electricity, and the material with which to supply this power is available in tropical as well as temperate-zone countries. Today great steamships are running from Borneo, in the tropics, to the ports of Western Europe, traveling a distance of 12,000 miles without a single stop, with power generated by liquid fuel drawn from the oil fields of Borneo; while in practically every section of the tropics, except the deserts, are available millions of horsepower in its water-falls, which may now be utilized, since man has at last learned to transmit that power from the place of production by wire and utilize it for operation of railways, trolley roads, or even horseless vehicles.

A Market Camel being Unloaded on a Sidewalk in Cairo, while Pedestrians Walk in the Street. Photo by O. P. Austin

I know that the query which will arise in your minds will be, "How can you successfully and profitably operate horseless freight vehicles in countries where there are no roads, as is the case generally in the tropics and the orient?" To this I reply, that if the freight-carrying vehicle is supplied, the roads will be constructed. A hundred years ago the roads of England were so bad that it took two days and three nights of incessant travel to go from Manchester to Glasgow; and at the beginning of the last century the time required for a trip over the bad roads from Philadelphia to Baltimore was often 5 days, or as long as it now takes to cross the continent. The fine roads of Europe and whatever we have of good roads in the United States have come chiefly in the last century in answer to popular requirements. The feasibility of making and maintaining good roads in the tropics is shown by the fact that India, which had no wagon roads when England assumed control in that country, is now noted for its fine and well-kept roads, aggregating nearly 200,000 miles in length. Give to the tropics and the orient a vehicle which will do what the horse does in the temperate-zone occident, and the plentiful supply of cheap labor in those countries will make road-building a mere incident of the development which will certainly follow.

The tropics and the orient are the great undeveloped sections of the world. Within the tropics are millions of square miles of productive land and billions of dollars' worth of products, for which the temperate zones are calling. In the orient are hundreds of millions of patient workers, and for their products the occident is increasing its demands. The inability of each of these sections to respond to our demands has been because of the absence of some available method of transportation. Given this facility, in the form of

Photo from David Fairchild, U. S. Dep't of Agriculture

A Caravan through the Desert

This picturesque means of transportation will in a few years be displaced by the auto truck and auto train

Photo from Bureau of Manufactures

An Automobile Train in Australia

the self-propelled vehicle, and with it a reasonable supply of temperate-zone energy and capital, and we shall see those countries develop, the iron horse extending his domain further and further into the interior and coming nearer and nearer to the door of every man, and with it an increased exchange of products, which will develop commerce, geographical knowledge, and general good fellowship between the people of all nations and all lands.

PLANTING FISHES IN THE OCEAN

The Marine Fish Culture Work of the United States Government

By George M. Bowers

Commissioner of Fish and Fisheries

THERE are very few countries that engage in the cultivation of marine fishes and crustaceans, and none that conducts the work on nearly so extensive a scale as does the United States. The only other country that deserves mention in this respect is Norway, which undertook the pioneer operations in marine fish culture, and has continued the cultivation of one species of fish at one hatchery up to the present time. Oysters and other mollusks are extensively cultivated in France, England, Japan, and other countries, as well as the United States, but only as a private enterprise.

The comparatively slight attention given to artificial propagation of marine fishes and other free-swimming creatures in Europe and all the other continents

except America may be explained in several ways. In the first place, government fish culture is almost unknown in most countries, and this form of agriculture is not practicable for the private fish culturist, who would not be able to reap the exclusive harvest from his labors. Then, many government fishery authorities, believing that man cannot permanently reduce the abundance of fishes by his fishing operations, however destructive, contend that he cannot appreciably increase their abundance by artificial means, however extensive. This view is far from being established by competent evidence, and is not generally entertained in the United States or elsewhere.

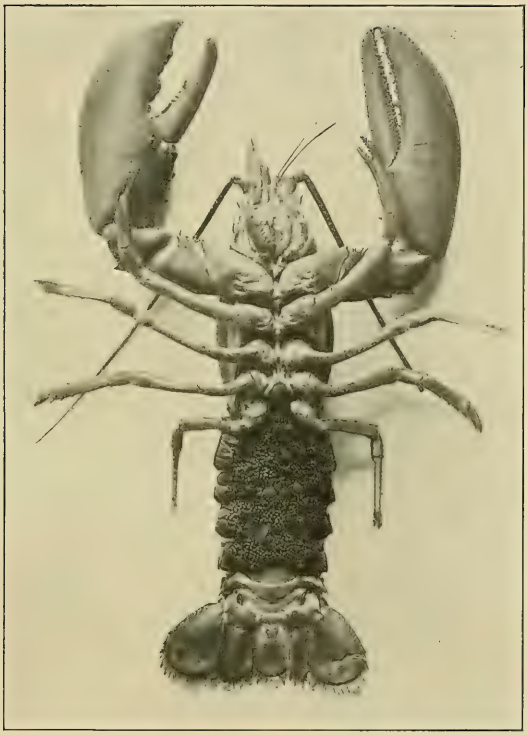
SPECIES CULTIVATED

At a very early period in the history of the National Bureau of Fisheries it was determined by Commissioner Baird and his associates that, in view of the government's lack of jurisdiction over the coastwise fisheries and its consequent inability to promote them by adequate regulation, the most feasible aid that could be rendered by the government would be through artificial propagation. The Bureau therefore took up the necessary experimentation looking to the adoption of extensive cultural operations, and soon determined the apparatus and methods applicable to the different species. The work has been conducted on a gradually increasing scale, and three government hatcheries, located at Gloucester and Woods Hole, Massachusetts, and Boothbay Harbor, Maine, are now maintained for the purpose. The fishes regularly propagated are cod at all the stations, flounders at Woods Hole and Gloucester, and pollock at the latter place. Other fishes—mackerel, tautog, sea bass, and scup—have also been hatched from time to time. Lobsters are hatched at all three stations, but the largest quantities of young are produced at the Boothbay Harbor station, recently established by Congress as a special lobster hatchery.

The great justification of marine hatching operations as conducted by the United States government lies in the fact that a vast majority of the eggs taken would be totally lost if the fish culturist did not come to the rescue. As to the few remaining eggs that might be extruded and hatched naturally, the increased efficacy of artificial propagation must be conceded.

OBTAINING THE EGGS

Cod eggs are obtained for the hatcheries in three different ways. The most prolific source is the catch of the fishermen on the Maine, New Hampshire, and Massachusetts coasts. Experienced spawn-takers board the fishing boats either on the fishing grounds or on the way to port, strip the eggs from the dying or dead fish, fertilize them, and then as soon as possible send them to the hatchery. This work, carried on in midwinter, involves great exposure and hardship, of a nature to be felt by the most stolid fisherman. The second method of securing cod eggs is to catch the mature fish with hand lines on the outlying shoals, take them to the hatchery in the wells of smacks, and hold them in live-cars pending the gradual ripening of their eggs. At regular intervals the fish are overhauled and the ripe eggs expressed and fertilized. Several thousand brood fish are thus handled at the Woods Hole station each year. An improvement on this practice has recently been tried at Woods Hole, as a result of personal observations in Norway by the Deputy Commissioner of Fisheries. The brood fish are held in a large covered compartment, and are allowed to spawn naturally; and the eggs, rising to the surface, flow over a shallow sluice and are collected in scrim bags or on a wire-mesh tray, whence they are transferred to the hatching apparatus. By this method the laborious task of forcibly expressing the eggs from the struggling fish is made unnecessary, a much larger percentage of eggs is obtained and fertilized, and the brood fish remain in excellent condition, and may be released when the spawning



Female Lobster, Showing Eggs Attached to the Swimmerets

The eggs are thus carried externally for 9 or 10 months

is completed. Pollock eggs are obtained from the boats of the market fishermen. The pollock is an excellent food fish, caught in immense quantities, and its artificial propagation is being conducted on an increasingly extensive scale.

The several hundred million eggs of the winter flounder that are now incubated each season are deposited naturally by captive fish held at the hatcheries in tanks of running water. The fish spawn at night, and practically a hundred per cent of their eggs are fertilized and hatched. Under the most favorable natural conditions a large percentage necessarily escape fertilization, many are devoured by other fishes, and many are washed ashore.

SAVING THE LOBSTER FROM EXTERMINATION

The operations of the Bureau of Fisheries in behalf of the lobster fishery are of the most beneficent character. Not-

Scraping the Eggs from a Live Lobster for Hatching Purposes

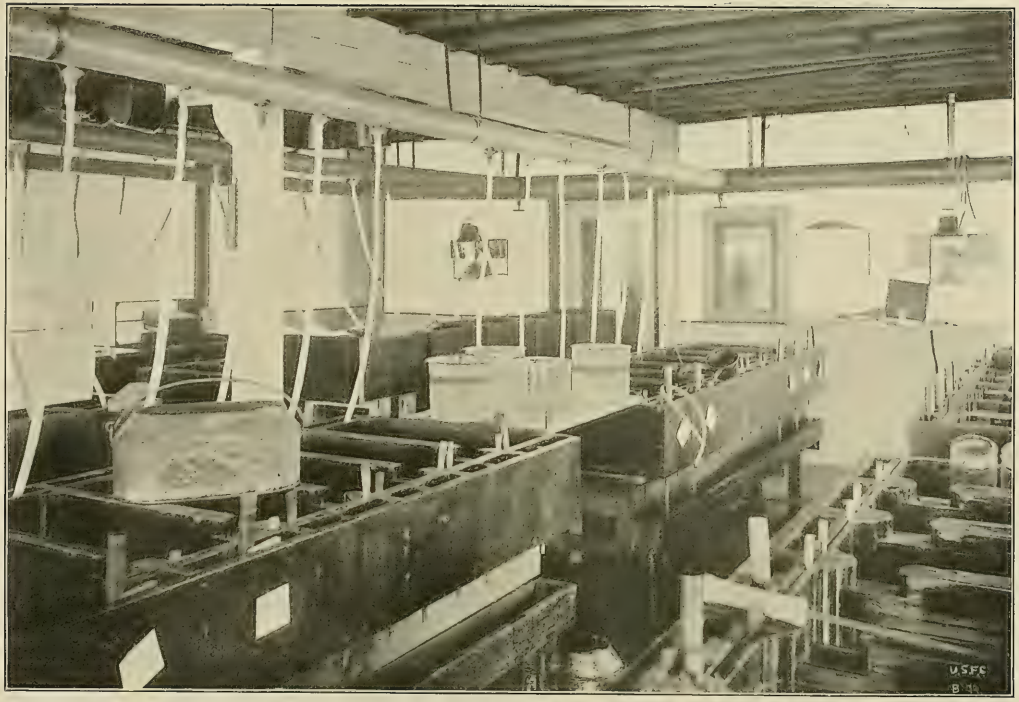
withstanding the enactment, by all the states interested, of stringent laws against the sale or possession of egg-bearing lobsters, such laws, as every one knows, have always been evaded or ignored by a large proportion of the lobster fisherman, especially in recent years, when the prices of lobsters have been high. It is an easy matter to strip the eggs from a lobster, and the fisherman who would return a lobster to the water simply because it was a "berried" female would be regarded by his associates as a crank. Seeing how the destruction of lobster eggs was going on, notwithstanding the efforts of the local fishery authorities to prevent it, the Bureau took up the matter with the states and secured a modification of the laws, by which the fishermen are now allowed openly to retain seed lobsters until agents of the Bureau take them off their hands, the fishermen receiving the ruling market price for their catch. The lobsters are first taken to the hatchery, where their eggs are gently scraped from the abdominal appendages, and are then carried offshore and released in deep water. In this way not only are millions of lobster eggs saved each year, but many thousands of mature female lobsters are given a new lease on life.

Since the establishment of the lobster hatchery on the Maine coast, egg-bearing lobsters bought during late summer and fall are held in large enclosures, or "pounds," until the following summer, and are then relieved of their eggs shortly before the time they would hatch naturally. Practically the entire New England coast is now patrolled by agents of the Bureau in quest of seed lobsters, the work being limited only by the attitude of the fishermen and the facilities and funds available.

HATCHING METHODS

The eggs of most of the marine food fishes float at the surface, and therefore require entirely different treatment from that given the heavy eggs of salmons and trouts on one hand and the semi-buoyant eggs of the shad and whitefish on the other. The incubation of immense numbers of floating eggs has been made possible by the invention of a very ingenious device known as the automatic tidal box. Such boxes, arranged in series in the compartments of a long trough, consist of wooden framework open at the top and covered with cheese cloth at the bottom. The water is supplied to each compartment by means of a tube which discharges into a little well, from which the water escapes with some force through a small aperture in the center of the back of each box; this current imparts a double rotary movement to the mass of eggs. In the front of each compartment a siphon works automatically and permits the entire renewal of

George M. Bowers, Commissioner of Fisheries



Interior of a Marine Hatchery

In the troughs, which contain the automatic tidal boxes, the eggs of the cod, flatfish, and other species are hatched

the water every 6 or 8 minutes. From 400,000 to 500,000 cod or similar eggs may be placed in one box, and these hatch with little attention from the fish culturist, owing to the complete oxygenation afforded by the circulation and frequent change of water. The young emerge in 10 or 11 days when the water temperature is 46° or 47° F., but the hatching may be deferred for 50 days in water of 31° F.

The eggs of the lobster are semi-buoyant and are susceptible to the same methods of hatching as the eggs of the shad—that is, in glass jars from which the young escape as they come from the egg and swim in the zone of water in the top of the jars. As the larval lobsters are cannibals from the moment of their emergence from the egg, it is necessary to keep them constantly stirred and to plant them as soon as possible in order to avoid wholesale mutual destruction.

EXTENT OF THE WORK

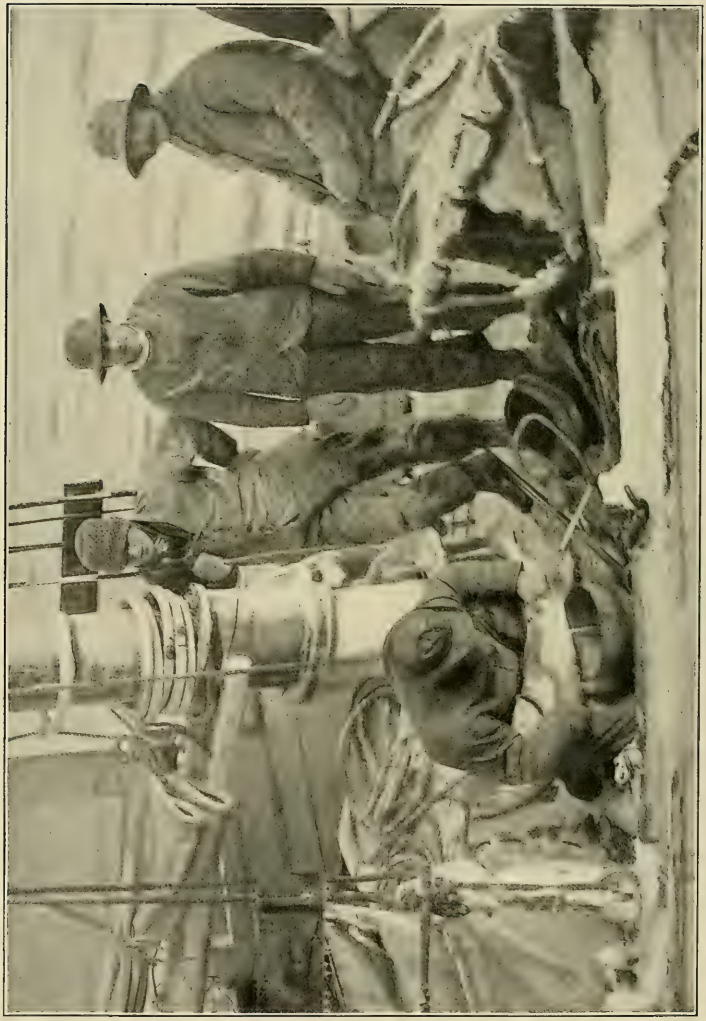
The magnitude of the fisheries to be aided and the area of the waters to be stocked have necessitated the most extensive fish-cultural operations on the part of the government. The yearly output of the hatcheries must be counted by hundreds of millions, and the efforts should be annually increased in order to offset the increased drain on the supply occasioned by the growing demand and larger numbers of fishermen engaged. Lack of facilities has up to this time prevented the rearing of lobsters and marine fishes, and tremendous destruction of the delicate newly hatched fry must thus be discounted by planting the young in far greater numbers than would otherwise be required. During the past ten years the Bureau has planted in New England waters more than 4,450,000,000 artificially hatched fish and lobsters. The output for 1907 was 654,680,000, which was much larger than for any previous year.

BENEFITS OF MARINE FISH CULTURE

The difficulty of determining the results of fish culture is greater in the case of marine operations than in any other branch. The products of the hatcheries are free to roam so widely and mingle with other fish to such an extent that it is almost impossible to separate the results of artificial propagation from those due to natural reproduction. Indeed, so little conclusive evidence can be adduced in support of marine fish culture that many persons are entirely skeptical as to its benefits.

As already stated, the Bureau of Fisheries has proceeded on the hypothesis that the effects of man's improvidence with regard to the shore-inhabiting species can be counteracted by sufficiently extensive artificial measures; and it has had ample justification for a continuance of its operations in the widespread popularity of the work and in the vast amount of unsolicited testimony received in the last twenty years showing the apparent increase in the abundance of the species handled at the hatcheries.

It was about 1889, some ten or twelve years after cod cultivation was systematically begun, that the first results began to be manifested. Schools of small fish, of marketable size, appeared on inshore grounds that either had never before had runs of cod, so far as known, or had been visited by only limited numbers of such fish. Careful observations conducted by the Bureau had traced the annual growth of the artificially hatched fry in the coastwise waters, and had left little doubt that the immense bodies of cod that had recently appeared were the direct outcome of the hatchery work. The fishermen were quick to take advantage of the new run of fish, and it was estimated that in 1889 the fishermen of southern New England had caught cod to the value of $250,000 on grounds where regular cod fishing had never before been profitable. The abundance of the so-called "hatchery cod" in the inshore bays and sounds has continued without interruption, and a definite fishery has been established. Furthermore, a most lucrative small-boat fishery has been built up on the shores of New York



Spawn-taker Obtaining Cod Eggs from a Fishing Vessel, Gloucester Harbor

and New Jersey. There has also been an increase in the numbers of small cod in the shore waters north of Cape Cod.

The downward trend of the lobster fishery had, up to a year or two ago, been apparently uninfluenced by the annual planting of large numbers of lobster fry; but there is now considerable evidence that the increasing output of the hatcheries is bearing fruit. Fishermen are reporting more under-sized lobsters than they have seen in many years, and in various places where fishing had been abandoned because it did not pay, the fishermen are now making good catches. It is difficult to understand how the annual planting of the progeny of 20,000 to 30,000 lobsters can fail to influence the available supply for the market, even if only one lobster fry in each hundred planted reaches maturity; and the Bureau has occasion to feel gratified that the decline has now been positively arrested in localities where large numbers of fry have been deposited for a series of years, and where there was absolutely no reason to look for any betterment, if nature had remained unaided.

HUNTING BIG GAME IN PORTUGUESE EAST AFRICA*

THE big animals of Portuguese East Africa are admirably described in a recent work by Mr R. C. F. Maugham, who was for a number of years British consul to that country. This section of the continent abounds in game, but curious and unaccountable gaps are sometimes observable in families common to neighboring regions. For instance, no ostriches are found, although numerous in parts of the neighboring British protectorate. The crested eagle is likewise absent.

"Of pigs, we have at least two—the grotesque wart-hog, with his large, curling tushes, and a smaller red hog, probably the *Potamochœrus chœropotamus* or *P. africanus*. The former (*Phacochœrus æthiopicus*) is very numerous throughout the drier, sandier districts, and in the mountains of both Cheringoma and Gorongoza I have seen them in large numbers. Their unsightly warts, two on each cheek, are much larger in the boar than in the sow, as are also the tushes, which in the former animal sometimes grow to such a size as to end their points up to a line with the eyes. They are very fierce when cornered, and I remember on one occasion a large boar I had wounded suddenly charged down upon a gun-bearer with a perfect cyclone of shrill grunts, and would assuredly have reached and injured him had not one of his comrades, who stood by, hurled a spear with great skill; this checked the animal's onset and enabled me to plant a fatal bullet behind his shoulder. The other variety is much smaller and, with a rather vivid red collar round the neck, possesses a long, thin white mane and a curious beard-like growth of white bristles under the jaw, which turn upward as though they were sedulously brushed. The body is of dark reddish brown, and this animal is, I may add, an exceedingly welcome addition to the sportman's larder.

"That enormous bald, hideous offal-eater, the formidable beaked marabou (*Leptolipus*), abounds in the interior, consorting with vultures, turkey buzzards, fishing eagles, and the *profanum vulgus* of the scavengers. Nobody who has not witnessed the spectacle could imagine the astounding rapidity with which all these birds, and many more, assemble from nowhere in particular when

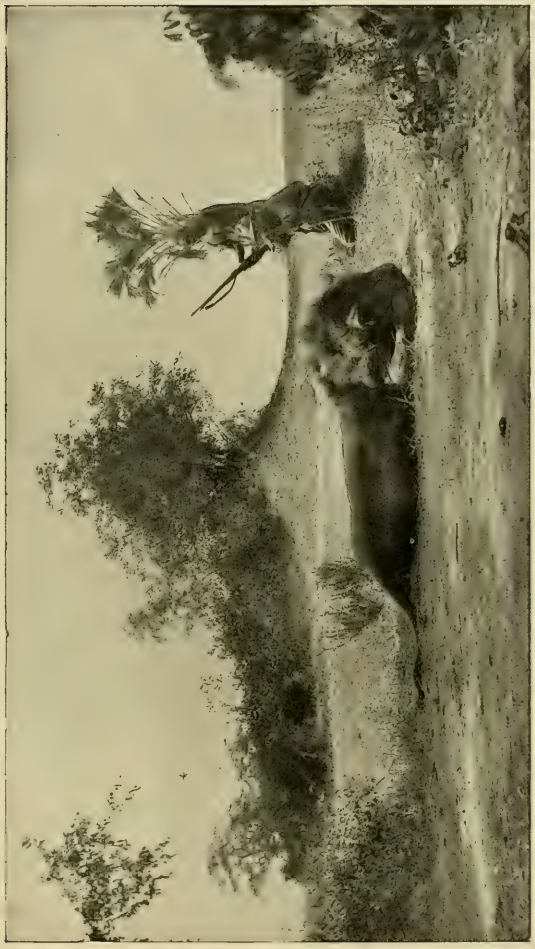
* Portugese East Africa: The History, Scenery, and Great Game of Manica and Sofala. By R. C. F. Maugham. With Map and illustrations. Pp. 340, 6 x 9 inches. New York: Imported by E. P. Dutton.

A Typical Native Village in Portuguese East Africa

This and the following six illustrations are from "Portuguese East Africa," by R. C. F. Maugham

Native Woman Pounding Maize

The Wart-Hog (See page 723)



The Fallen Monarch

A Fair-sized Bull Hypopotamus

Native Drums

some large beast is being skinned and cut up on an exposed plain.

"I remember last September that, having shot a large elephant in surroundings such as I have described, I sat by while the great slabs of skin were removed from the gigantic sides, and the carriers, hastily summoned from the camp and reinforced by people from a neighboring village, proceeded to cut up the vast mountain of flesh. Almost immediately a shadow flitted across the carcass, and looking upward one became aware that the deep blue above was rapidly filling with countless black wheeling specks. The sense of sight possessed by all these birds is incredibly acute, for, during the whole period we were engaged in cutting the elephant up, they continued to congregate. The buzzards, kites, and scapulated crows boldly alighted on the grass and on a few neighboring bushes and awaited calmly the moment when we should take our leave, while overhead, at a great height, the shyer varieties, including the marabous, large bare-necked (probably *Gypohierax*) vultures, and screaming fishing eagles continued to hover.

"At length, all the meat was carefully apportioned, the tusks chopped out, and all that remained of the great elephant were some huge bones and other fragments lying in a confusion of trampled internal organs. We started for the camp, but before we had marched 20 yards every one of those waiting birds was settled upon the remains, while, with a rush like the roar of a war rocket, the greater vultures fell with wings tightly folded from a height of 300 or 400 yards to take part in the feast. The startling noise made by these heavy birds falling head foremost through the air, to check their plunge with outspread wings so close to the ground as to make destruction appear inevitable, was most singular and impressive.

"Dancing and singing are the principal

Traveling in Pre-railway Days, Portuguese East Africa

forms of native amusement, and are indulged in all over the country about the time of full moon. The music of the drums is the most general form of accompaniment, and many of the people become astonishingly expert in beating them. The number of drums used at one time is as a rule three, and this number is never allowed to exceed five or six, although on one occasion, when I was in Maravi's main town, close to Mozambique, I witnessed a dance in which over 2,000 persons took part, to music furnished by over thirty drums. On this occasion three immense rings were formed, and the drums were stationed a little way off. This was the most imposing festivity of the kind at which I have been present."

Mr Maugham gives an interesting summary of Portuguese exploration and settlements in Sofala and Mozambique. When the Portuguese came in 1502 they found the region ruled by an Arab sultan, whose vessels traded in slaves and gold and ivory along the East African coast. The region was fabled for its wealth, and, in fact, Mr Maugham believes that the wild jungle in which he hunted was "the legendary Land of Ophir" itself; "that land to which King Solomon of old sent the vessels which enriched his treasury and enhanced his influence, and to which the ancient Phœnicians sent their fast-sailing argosies, to return laden with the riches of the land of Punt."

No part of the world arouses greater curiosity or is veiled in deeper mystery than the hinterland of Portuguese East Africa and the neighboring territory of Mashonaland and Rhodesia, where the ruins of many cities surrounded by walls of solid masonry have been found, but not a single inscription to tell of their inhabitants or age.

A VISIT TO LONELY ICELAND

By Perley H. Noyes
Member of the National Geographic Society

ABOUT the year 860 A. D. a Norwegian pirate named Naddodd, who had been forced to settle in the Faroe Islands on his return from an expedition against Norway, was driven by a storm far out of his course and sighted land considerably to the north, which, from the amount of snow on its mountains, he called Snaeland, or the Land of Snow. Four years later one Gardar Svafarson, a Swede, being similarly driven northward against his inclination, sighted this same land, which he circumnavigated and discovered to be an island. On that account he called it Gardarsholm, or Gardar's Island, and, having spent a winter on its northern shore, at the site of the present little town of Husavik, he returned in the spring to Norway.

Gardar gave so favorable a report of the new country that the adventurous spirit of another Norwegian pirate, Floki, prompted him to go in search of it himself, with the idea of taking possession of it. He proceeded, accordingly, first to the Shetlands, and then to the Faroes, whence he sailed northward on his journey. The compass not then being known, Floki resorted to a novel method of apprising himself of the proximity of land. He took with him three ravens, consecrated to the gods, to guide him on his way. The first of the birds he let loose after having lost sight of the Faroes, and it took its flight back thither; the second, which he loosed later, rose to a great height in the air, and, after hovering about for some time, returned to the ship; the third directed its course northward, and Floki shortly afterwards landed on the island which he sought.

He appears to have spent too much of his time in fishing, neglecting the hay harvest, in consequence of which all the cattle he had brought with him died during the winter. Greatly vexed at this loss, Floki determined to seek a more favorable climate, but before leaving the island he chanced to notice from the top of a mountain near the coast that one of the bays was completely filled with ice, and because of this he renamed the island Iceland, and this name it has ever since retained. In 870 Iceland was again visited by Norwegians, Hiorlief

An Icelander Knitting Socks

and Ingolf, and being well impressed with the country, after a winter's residence there, they returned to Norway to fit out an expedition which should make a permanent settlement on the island. This they did in 874, and the Icelanders date the occupation of their country from that year.

So much for the discovery of the islands and its first settlement. Whether or not natives of Ireland had lived in Iceland previous to its discovery by Noddodd seems to be a disputed question. At any rate, the evidence relied upon in support of the supposition is very meager.

The early colonization of Iceland was greatly promoted by the tyrannical rule of Harold the Fair-haired in Norway. His relentless oppression drove from that country many of the petty kings, who preferred independence in a strange and unknown land to persecution and humiliation at home. These nobles took to themselves considerable districts in Iceland, and for nearly 400 years governed the island with no interference from the outside world. Internal feuds, however, had been going on over a good part of this period, and at last, in 1261, Hacon, the king of Norway, succeeded in effecting the subjugation of Iceland to Norway. In 1387 it passed to Denmark and is today one of her colonies.

NOT A BITTERLY COLD COUNTRY

Many misconceptions as to Iceland exist in our country. It is, perhaps, generally thought of as a cold and snowy land, inaccessible except after much inconvenience and possible hardship. It may seem surprising to many to know that the Icelanders who have emigrated to America are said by their relatives at home to complain bitterly of the extreme cold of our winters. Mr Halldor Bjarnarson, a Lutheran minister, residing at Prestholar, a parsonage on the north coast of Iceland, writes me of the past winter in his district, that at no time did he observe the temperature to drop below +5° Fahrenheit, and that in the north of Iceland, almost on the Arctic Circle.

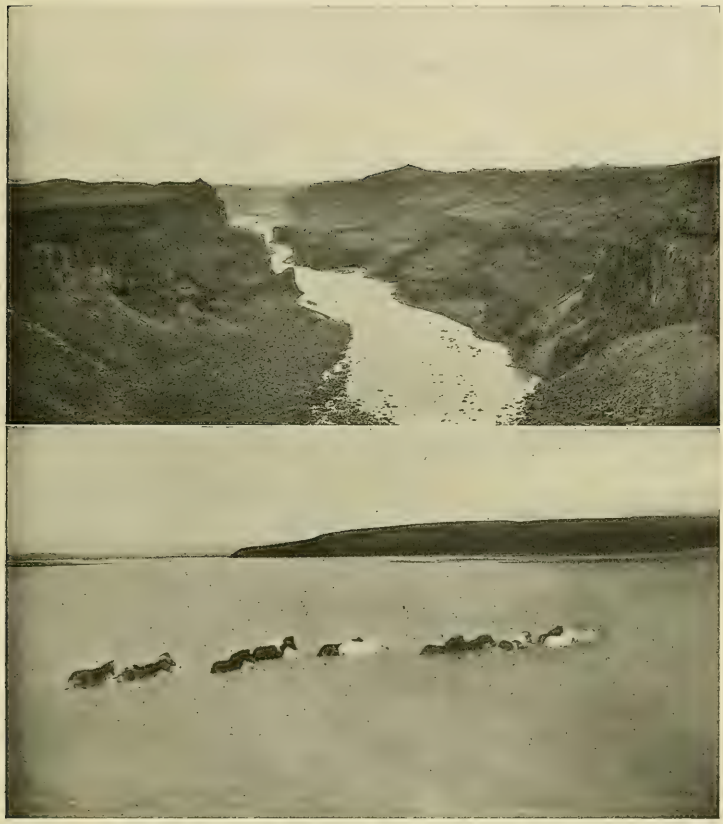
Two lines of steamships maintain regular all-the-year sailings between Denmark, Scotland, and Iceland by way of the Faroe Islands. The single passage to Reykjavik, the capital of the island, on the southwest coast, requires from three to four days from Leith, or five to seven days from Copenhagen, and the steamers of these lines are annually carrying more and more tourists to an island which is but just becoming recognized as one of the most interesting and fascinating lands in the world. The trip is usually taken from Leith, as this avoids the extra two days required in the passage across the North Sea from Copenhagen, a passage often rough and disagreeable, in a steamer of the size of those employed in the Iceland trade, which average, perhaps, 1,000 tons gross. Excluding meals, which cost one dollar a day, the round-trip fare between either Copenhagen or Leith and Iceland is about thirty dollars—certainly moderate in view of the distance covered. I have thought it best to include these items as to the time required and the cost of the trip to Iceland because of the inconvenience of ascertaining them.

Most of the steamers go direct to Reykjavik, some of them stopping at the Faroes on the northward voyage and others on the southward voyage. Some, however, proceed up the east coast of Iceland, thence westward along the north coast, and south to Reykjavik, and thence back to Leith, while others make the trip in the reverse order.

UNCHANGING THROUGH THE CENTURIES

So far I have said nothing as to travel on the island itself. The method employed is unique and primitive. Barring the possibility of driving on a narrow carriage road for about one day's ride from the capital, and possibly a less distance from some of the smaller towns, all travel must be made on pony-back. Much has been written about the Icelandic pony. He is individual, a type by himself, and the word "sturdy" is his best description. Those who contemplate long journeys on the island must be provided with two riding ponies, in addition to one or more pack ponies apiece, depending on the needs of the party. With such an outfit, 50 miles a day is easily possible.

The Iceland of today is little different from the Iceland of over one hundred



Great Canyon of the Jokulsa

Ponies Fording the Thjorsa

years ago. The same occupations, the same pleasures, the same dangers, make up the life of a simple, sincere, and hospitable people. In a country so isolated from the world, equally apart from its commercialism and its politics, there has indeed been little chance for change. The traveler who visits this country, especially those parts of it which lie remote from its semi-Danish capital, cannot but find refreshing the unsuspicious and open-hearted candor of its inhabitants. Those who travel across the island have the better opportunity of observing this, for every man's house is open to the traveler at whatever point he may choose to stop.

The Gullfoss or Gold Fall

Indeed, this custom is a necessity, for there are no towns in the interior, but only solitary farm-houses—often parsonages—each boasting its own name, and unless the traveler prefers to sleep in a tent, which he must then carry with him, there is no other shelter available.

The chief drawback to a summer's excursion to this lonely island is the frequency of rain at that season; but if this be borne in mind and provision made in advance to meet it, the charm of the great natural wonders of the country and the interest, which cannot but be aroused, in its people and their history so completely offset the discomforts of travel as to make them at best one's second thoughts.

The trip most generally taken by travelers in Iceland is made from Reykjavik and includes a visit to Thingvellir, Geysir, and Mount Hekla. Thingvellir is a wild and picturesque tract of land and water lying at a level lower than that of the country round about it. That the subsidence of this district occurred during some violent volcanic agitation of prehistoric time is unquestionable; it is conclusively proved by corresponding stratification on the faces of the cliffs of the perpendicular walls on either side of the sunken district and on the walls of the sunken tract itself. Thingvellir is the dominating point in the annals of Iceland. For nearly 900 years the Althing, or general assembly of the people, met on this spot, and the public affairs of the country were here discussed and justice administered. It was here also, in the year 1000, that after a fierce debate it was decreed that Iceland should renounce the pagan for the Christian faith. In 1800 the Althing was removed to Reykjavik.

After Thingvellir it is customary to visit Geysir, where is located the most famous group of the boiling and spouting springs of Iceland, from one of which, the largest on the island, the place derives its name. The height of the column of water thrown up by this fountain when in eruption has been variously measured and conjectured; it has a known record of considerably over 100 feet, but perhaps its average today would not be much in excess of 60 feet.

A Group of Icelandic Farmers and Ponies
An Icelandic Dog and Puppy

A Schoolboy

Drying Codfish

THE FAMOUS FALLS

Near Geysir, at a riding distance of about an hour and a half or two hours, is situated, on the Hvita, or White River, the Gullfoss—Gold Fall. The Gullfoss descends in two immense cataracts which together are said to more than equal the height of Niagara. The Hvita takes its rise in Hvitarvatn, a lake fed by the melting ice of the Lang Jokull, a large glacier lying from 20 to 25 miles north of the Gullfoss. The waters of the Hvita, like those of all the other glacier rivers of Iceland, are of a dull, yellow color, very swift and cold. As they leap over the immense precipices of the Gullfoss and boil and foam in the narrow gorge below, such an impression of grandeur and majesty is aroused as would be well nigh impossible to awaken elsewhere. Both in volume and in picturesqueness the Gullfoss far surpasses its only Icelandic rival, the Dettifoss, in the north.

After visiting Geysir and the Gullfoss, the majority of tourists, who have but a short time at their disposal, proceed in a southeasterly direction, across the Hvita and the Thjorsa to Hekla, the most famous, although not the largest, volcano in Iceland. As I did not visit Hekla personally, I cannot speak authoritatively as to the difficulties of its ascent. It is said, however, to be a reasonably easy climb, but an entire day is required and an early start is imperative.

The trip from Reykjavik to Hekla, as I have described it above, should take not less than six or seven days. The return trip may be made by a more southerly route, on which the hot springs, boiling mud cauldrons, and sulphur beds of Krisuvik may be examined. This return journey will extend the time required to a total of eleven or twelve days.

THE INTERIOR OF THE ISLAND IS DESERT AND BARREN

The interior of Iceland is a vast desert of rubble and sand, broken up by mountains and glaciers, and almost utterly devoid of vegetation. Across one of the routes of this desert, the Sprengisandr, or "Bursting Sands," our party journeyed to the north coast of the island. The Sprengisandr has been little described, for but few choose to cross Iceland by this inhospitable route. It is seldom used, even by the Icelanders themselves, almost all preferring to lengthen the journey by taking the more accessible and less dangerous coast routes. A guide thoroughly familiar with the Sprengisandr and its environment is absolutely essential, for the long ford of the Thjorsa, which the party must cross before reaching the desert proper, is difficult to locate, and, once across the river, the dangers of losing the way and of becoming entangled in the quicksands from which this route derives its name are not merely nominal.

In order to convey an accurate idea of the barrenness of the interior of Iceland, even at the risk of digressing, I cannot do better than quote from Mr W. G. Lock's "Guide to Iceland," published in 1882, but even today the best and most painstaking handbook of the island. He says (page 38): "Broadly speaking, only the fertile tracts and valleys of the coastal regions are inhabited, the interior being mainly a barren elevated plateau, studded with ice-clad mountains and slumbering volcanoes; and it is believed there are not half a dozen houses in the whole island distant in a beeline forty miles from salt water." To appreciate the full significance of this quotation it must be understood that Iceland contains 38,000 square miles, over 5,000 square miles more than Ireland.

To return again to the Sprengisandr. Properly speaking, the Sprengisandr itself requires but one day to cross, but from the time one leaves the last farmhouse in the south until the first habitation is reached in the north, no less than four days are required; during this time we did not see one human being besides the members of our own party. The chief reason which operates to make the Sprengisandr and its approaches im-

Milking Time

practicable as a traveling route is the extreme scarcity of grass for the ponies. The desert itself offers absolutely none, and even after this part of the route is covered the forage is very meager. In consequence, our ponies were obliged at one time to go for over twenty-four hours without food of any kind.

If the term scenery may be used of the region of the Sprengisandr, that which presents itself during the time necessary to reach the first fertile land in the north is monotonous beyond expression. The vast undulating plains of the desert, broken here and there by small hills of the same sand and volcanic ash, offer no other obstruction to the eye than slender wooden stakes, ten or twelve feet in height, placed at intervals of perhaps 400 or 500 feet for the guidance of the winter wayfarer who may elect to expose himself and his pony to the inclemency of this route at a season when it is covered to a considerable depth with snow. Where the desert joins its rocky and mountainous approach on the north, these stakes give place to high rock cairns, standing like sentinels on every elevation of a forbidden and hostile region.

The Sprengisandr lies between two immense glaciers, one of which, the Vatna Jokull, or Great Glacier, is said to be the largest in all Europe. Because of its situation, the desert is continually exposed to the fierce winds and snows which sweep across these ice-fields. For over half the day, in August, on which our party crossed the desert, we rode in the face of a driving snow-storm, which, although it had abated somewhat by nightfall, did not wholly cease until nine o'clock of the following morning. The cold was intense, and with our comparatively light sleeping equipment the night was spent very uncomfortably.

After reaching the first farm-house, Myri, in the north, one day's ride brought us to Akureyri, which is the second town in point of size on the island. Here our party separated, the majority returning to Reykjavik by the western-coast route, while two of us, with one guide and a complement of nine ponies, went eastward.

The Town of Seydisfjord, at the Head of the Fjord of the Same Name

ACRES OF BURNING SULPHUR BEDS

The north of Iceland is not nearly so often visited by tourists as the southern portion, and yet, to me, it was far more interesting than the more traveled south. Two days to the east of Akureyri lies an immense tract of devasted territory, to which has been given the singularly appropriate name "The fire focus of the north." The activity of this region is now undoubtedly past, but the mind could not picture a scene of greater desolation and waste, while acres of burning sulphur beds, with small geysers and boiling mud cauldrons, still exist in evidence of the dying fires beneath. Here we employed three days in visiting the extinct volcanoes and other points of interest in the neighborhood, proceeding north to Husavik, on the coast, and thence eastward again to the Jokulsa, a large river fed from the Vatna Jokull in the south.

The Jokulsa, in its course to the Arctic Ocean, has cut a deep and picturesque canyon, through which pours a volume of water in amount second only to that of the Thjorsa. Near the banks of this stream in the north is situated the famous V-shaped valley of Asbyrgi, supposed to have been caused by the subsidence of the roofs of two subterranean lava channels at and near their confluence.

Before going northward to Rifstangi, the most northerly point of Iceland, just over the Arctic Circle, we visited the Dettifoss, a tremendous cataract of the Jokulsa, and a group of craters and masses of igneous rock, to which has been given the unpronounceable appellation of the Hljothaklettar.

It was on our way to Rifstangi that chance took us to the church-farm of Prestholar. Here we met the minister of the district, Mr Halldor Bjarnarson, whom I have mentioned before, and his

An Icelander's Family

A Farm-house and Farm-yard

brother, Mr Paul Bjarnarson, and nothing can better illustrate the hospitality and courtesy of the Icelanders than the fact that these gentlemen took voluntarily three days of their time to accompany us over a section of their island with which our guide was unfamiliar. At Prestholar we saw the message found in the drift-cask set loose by the Geographical Society of Philadelphia, the probable drift of which was outlined in the National Geographic Magazine for January, 1906. The cask had been picked up by a farmer living near Prestholar, and being unable to read the message it contained, although it was printed in four languages, he had taken it to the Messrs Bjarnarson, by whom it was forwarded to Philadelphia.

Our principal concern in going to Rifstangi was to reach by land the most northerly point in Iceland, and, if the memory of the immediate inhabitants of this district may be relied upon as accurate, no foreigners had ever before reached the spot in this way. There is nothing particularly difficult about this part of the trip, except that the road, if it may be called a road at all, for the last few hours of the ride leads over an unbroken mass of boulders and round stones, among which any other horse than a native pony would inevitably break his leg.

From Rifstangi to Seydisfjord, whence we left for Scotland, the trip was comparatively uneventful. The east coast of Iceland is exceedingly mountainous, and each day succeeded the preceding in substantially the same way—*i. e.*, we would ascend some mountain in the morning, travel across a high plateau for the greater part of the day, and descend to some farm or coast town in a valley or fjord for the night. The descent to Seydisfjord was particularly beautiful. After winding in and out among great ridges of rock, the road bends abruptly and the little town at the head of the fjord comes suddenly into view far below, each little white-painted house a mere speck in the distance. From this point it is nearly two hours' ride to the town itself.

The trip which I have detailed above occupied approximately four weeks. During that time we had abundant opportunity for observing the character and disposition of the simple people to whom Iceland is "home." Even should the marvelous scenery of the island fail to awaken the visitor's enthusiasm, he cannot leave its shores without admiration for the loyalty and devotion of its inhabitants to a land so unfavored both by nature and geographical position.

THE LAND OF FIRE*

By Herr Jon Stefansson, Ph. D.

GEOGRAPHICALLY and geologically Iceland is part of—a continuation of—the British Isles, for it is situated on the same submarine mountain ridge, stretching from southeast to northwest across the North Atlantic, the average depth on it being 1,500 feet to 2,000 feet, while north and south of it 12,000 feet is the average depth, reached by sounding. According to Prof. James Geikie, land connection between Greenland and the British Isles must have existed in Cenozoic times, for relics of the same Tertiary flora are found in Scotland, the Faroes, Iceland, and Greenland.

It is as rational to call this island Iceland as it is to call an ice-sheet meas-

* Abstracted from "Iceland; its History and Inhabitants." By John Stefansson. Smithsonian Institution, 1907.

uring several hundred thousand square miles Greenland. Iceland is not a bleak, arctic region, embedded in thick-ribbed ice, though its northernmost peninsula, Rifstangi, projects a mile north of the Arctic Circle. Though situated between 63° 24′ and 66° 33′ north latitude, its thermic anomaly is such, owing to the Gulf Stream, that the mean temperature of the month of January on the west coast of Iceland is 34.5° F. higher than it should be in that latitude. It is surprising that January at Reykjavik is milder by 1½° than at Milan, north Italy, or 1° F. milder than at Munich, which is 3½° farther south than London.

Grimsey, off north Iceland, cut in two halves by the Arctic Circle, is 5° F. warmer in January than Stockholm. The coolness of the summer, however, owing to the nearness of polar ice drifting down from Greenland, reduces the annual mean. It will thus be seen that Iceland has a temperate climate, while the clearness of its atmosphere rivals that of Italy. It is freer from microbes than the air of any part of Europe, and, according to the researches of Dr W. L. Brown, the blood of the Icelander on an average contains more hemoglobin than that of other inhabitants of Europe.

No country on earth of equal size contains so varied and wonderful phenomena. The glaciers of Switzerland; the fjords, salmon rivers, and midnight sun of Norway; the volcanoes, grottoes, and solfataras of Italy, on a grander scale; the mineral springs of Germany; the geysers of New Zealand; the largest waterfall, next to Niagara, in the world—all are here. Nowhere has nature been so spendthrift in giving a geological lesson to man. If there be sermons in stones, volumes lie unread here. Here we see her Titanic forces at work building up a country. Nowhere is it possible to study so well the geological conditions prevailing toward the close of the Glacial Epoch in Europe.

Iceland is the center of a suboceanic volcanic region, and no region of the earth has an equal title to be called the "Land of Fire." It owes its very existence to volcanic agency continued today, and may be truly called the abode of subterraneous heat. No spot on the surface of the globe of its extent exhibits marks of fire in such a multitude, in such a variety, and of such a magnitude. None contains an equal number of volcanoes. Nowhere have eruptions of such magnitude occurred. Dr Thoroddsen has counted 107 volcanoes, 83 of which are a series of low craters or crater chains, 8 are of the Vesuvius shape, and 16 of the Sandwich Islands lava-cone shape. Five thousand square miles of land are covered with lava. The post-Glacial lava alone would cover Denmark with a layer 16 feet in thickness. The largest lava desert is the Odaoahraun, which covers an area of 1,700 square miles and is from 1,600 to 3,500 feet above sea-level. This lava field has been formed by the eruptions of about 20 volcanoes. The cubic capacity of the lava ejected here would make a solid cube, each side of which would measure about 50 miles. The most frequent form of manifestation of volcanic eruption is the formation of a series of low craters, often several miles in length, along lines of cleavage in the crust of the earth. The longest is that of Laki, 20 miles long, containing about 100 craters.

Sometimes lava has welled up out of fissures without craters. The largest of these is Elvgja, north of Myrdalsjokull, 19 miles long, 434 feet deep—in one place, 656 feet deep—the bottom being 468 feet wide. The volcanoes are not, as was formerly supposed, limited to the regions of palagonite breccia. On the Faxa Bay are many small volcanoes which have broken through the basalt. About 25 volcanoes have been active in historic times (900-1900). Vesuvius is dwarfed into insignificance, for the lava flood of the last eruption in Iceland, in 1875, has been computed to contain 31,000 millions of cubic feet, while in the largest eruption of Vesuvius on record, that in 1794, only about 7,000 millions of cubic feet of lava were ejected.

Iceland has another and greater claim to one's interest. It is, as William Morris said, "the Greece of the North." It produced in the twelfth and thirteenth centuries a literature unparalleled after Rome before the golden age of England and France, in character drawing, in passionate dramatic power, in severe, noble simplicity, in grim humor. All the characters of the Sagas live and move today. Every hill and headland and valley in the island is full of their presence. The Icelander of today knows them by heart. It is as if every Englishman, from pauper to king, knew Shakespeare's historical plays and could retell them more or less in his or her own words. It has kept the national times alive through evil times. It has preserved the language almost untouched by time and foreign intercourse.

Nowhere is the contrast between man and his surroundings so glaring as in Iceland. Buried in snow and darkness, deprived of every comfort, living on rancid butter and dried fish, drinking sour whey and milk, dressed like his servants, seeking in a little boat his food, yet a cultured mind, possessing an intimate knowledge not only of the history of his own country, but of Greece and Rome; a poet fond of throwing off satires, intellectually and morally the equal of his European guest, considering himself your equal and refusing to be ordered about by a rich Englishman, owner of several square miles of land and hundreds of sheep, with a pedigree going farther back than that of his visitor; a jack-of-all-trades, a blacksmith in his smithy, boat-builder and carpenter, an artist in filigree work, a carver in wood, an eager reader in books, he has universal education up to the degree to which it is useful for a man.

There are no schools in Iceland, yet every child at 12 can read, according to the parish statistics. In no country in Europe are so many books printed and sold, in proportion to the population. A population of only 76,000, scattered in many hamlets, has 12 printing presses, the earliest being established as far back as 1530; about 100 books annually, 14 newspapers, and 8 periodicals are produced to satisfy the literary needs of this little nation.

Yet this literary people still live in a pastoral and Homeric civilization, which is a modern lesson of the healthfulness of human life lived in close contact with the free, wild life of nature, such as would have delighted the heart of Rousseau or Thoreau. As a proof that this life is healthy, I give the example of a clergyman who died four years ago 113 years old, having managed to live all his days healthy and happy on £30 ($150) a year, the average stipend in the Icelandic church.

The sheep yield food and clothing. Their wool is pulled off in spring, carded, spun, woven in hand looms, and worn undyed. You make shoes of their skin and spoons of the horns. Every opportunity is seized for the telling of stories and reciting of poems. Only the milk ewes are kept at home in the summer to be milked; the rest of the sheep are gathered in from the mountains in autumn, notice being given at church from the pulpit.

The autumn gatherings, with people sitting on the walls of the stone inclosure telling stories, are quite Homeric. The winter evenings are spent with each member of the family busy at work in the same room; the men on their knees shaving the wool off sheepskins, making ropes and nets of hair; the women using spindle and distaff, embroidering, etc., afford a still better opportunity for stories and puns.

There are even wandering minstrels who gain their livelihood by reciting prose or poetry, which they know by heart, at various farm-houses, till they exhaust their stock.

To conclude with a few statistics: The annual trade of Iceland is worth close on £1,000,000 ($5,000,000), export and import together. The principal articles of export are salted codfish, wool, mutton, and eider down. A large increasing

part of the trade is with Great Britain. In the fifteenth century all the foreign trade was in English hands. Henry VIII negotiated with Denmark in 1518 and 1535 for its transfer to England, and its economic and strategic importance to Great Britain has been set forth as late as 1835 in the Quarterly Review by Sir George Mackenzie and Sir William Hooker, who held that Iceland ought to be a British possession. It has been declared by experts that the fishing-grounds of Iceland are richer than those of Newfoundland, and, though they are much nearer Great Britain, their annual yield is not more than £2,000,000 ($10,000,000), because they are not worked as they ought to be.

For four hundred years Iceland was an aristocratic republic, ruled by the great families of the early settlers, among whom was a Norse queen of Dublin. A fourteen days' open-air parliament of all Iceland met annually in June at Thingvellir, and the speaker of the law (lög-söguman) used to recite from memory the whole of the unwritten, elaborate laws of the country to the assembly. In 1262-1264 Iceland was united to Norway, and in 1380 with Norway to Denmark. The Danish rule ruined the island economically, but since the granting of self-government and the reëstablishment of the old parliament, in 1874, at Reykjavik, great progress has been made. The revenue of Iceland is now six times as large as 28 years ago, and it is probably the only country with no debt, but with 1,000,000 crowns of savings in its exchequer; yet more has been expended on the ways and roads of the island since 1874 than in all the previous centuries.

The Icelanders are keen politicians; women have been in possession of the municipal vote earlier in Iceland than in any other country, and they do not change their names when they marry. The parliament (althing) is composed of an upper house of 12 members and a lower house of 24.

SCENES FROM EVERY LAND

Copies of "Scenes from Every Land," by Gilbert H. Grosvenor, are now being forwarded to members of the National Geographic Society who have ordered this volume. Owing to the popularity of the suggestion, it was necessary to print a larger edition than had been planned, and therefore the publication has been delayed several weeks.

The volume contains more than 250 illustrations from the Magazine, with 50 to 200 words of description under each picture; a list of nearly 1,000 books of travel, exploration, and general geography, as well as a small map in five colors. Three-fourths of the edition have already been disposed of. The remaining copies will be reserved for members of the National Geographic Society and readers of its Magazine until December 15, after which the balance will be obtainable by the public.

PHOTOGRAPHIC COLLECTIONS

Mr Herbert L. Bridgman, of Brooklyn, has sent to the library of the National Geographic Society a series of fifty photographs of scenes in Khartoum and Egyptian Sudan, taken or purchased by him on a recent visit to that region. Mrs J. Howard Gore, of Washington, has presented to the Society a series of Swedish pictures illustrating the costumes and manner of life of the Swedish peasants.

It is hoped that members of the Society who have an opportunity of taking or collecting photographs during their travels will send them to the library of the Society. If members do not care to part permanently with their pictures, but wish to place them where they will be safe from fire and be taken care of, it is suggested they send them also to the Society. Such pictures will be returned whenever the member desires, and will not be published without the consent of the owner.

A Special Exhibition of the Sacred Tooth, Kandy, Ceylon

The Sacred Tooth (of Buddha) was brought to Ceylon from India by a princess and enshrined in a palace of its own. It was carried off as loot by one of the Malabar raiders of Ceylon ten centuries later, recaptured and returned to Ceylon, and treasured in a hidden shrine until 1560, when the Portuguese took it and carried it to India, where they burned it with great pomp and threw the ashes into the sea. The King of Kandy thereupon had a new tooth, 3 inches long, made of choicest ivory and enshrined in the place of the lost one. Photo from Miss Eliza R. Scidmore in "Scenes from Every Land."

HELPING THE FARMERS

NO government in the world spends so much for the development of its farms and farming interests as does that of the United States. Many millions of dollars are annually appropriated by the U. S. Congress and our state legislatures for practical experiments and researches to increase the profit of our farmers by creating or finding new and better products for them to grow or to protect or improve the soil of their farms. As a result, much greater progress in practical agricultural science and methods have been and are being made in the United States than in any other country.

One of the most interesting and impressive annual volumes of the national government is the yearly Report of the Office of Experiment Stations of the U. S. Department of Agriculture, which summarizes the work in progress at the many state experiment stations. The list of investigations at the Wisconsin station, at Madison, as given in the last report, is typical of the others. Here they have discovered improved methods in cheese-making which will mean an increased annual profit of $150,000 in this industry to Wisconsin alone. They have also found that by spraying with iron sulphate solution it is possible to destroy wild mustard, oxeye daisy, cockle burs, and ragweed in oat fields without injury to the oat crop. The strength used has been about 100 pounds of iron sulphate to 50 gallons of water per acre, and the cost of material from 60 to 75 cents per acre—much less than for a copper sulphate solution. The pictures on pages 474-749 illustrate other lines of work at this station.

One of the most important efforts of the national and state governments is to encourage the study of agriculture in the schools and colleges and to help the Farmers' Institutes. These institutes are now organized in all of the states and in all of the territories excepting Alaska. The number of institutes held in 1906 was 3,409, and the number of sessions 11,409. The attendance at these institutes was 1,299,172, an increase of 403,980 over the attendance of the previous year. The average number at each session was 114. The appropriations for the institute purposes amounted to $269,672. Fifteen states reported round-up meetings, with an attendance of 24,598; 19 states held special institutes, attended by 85,762; 13 states reporting upon agricultural trains give an approximate attendance upon these trains of 215,890. The aggregate attendance for the year, including the regular institutes, the round-up meetings, special institutes, and railroad specials, was 1,625,422. The number of institute lecturers increased from 995 in 1905 to 1,225 in 1906.

NATIONAL GEOGRAPHIC SOCIETY

Members changing their addresses should notify the Society at the earliest moment in order that the Magazine for the current month may be correctly forwarded. When this is not done duplicates very often cannot be supplied, as the edition of the Magazine may become exhausted.

Members desiring to attend the annual banquet of the Society on December 14 are requested to send to the Society at once their names and the number of reservations desired. The price per plate is $5.00. The program for the evening has not been completed, but one of the features will be the presentation of the Hubbard Gold Medal to Captain Roald Amundsen, of Christiania, Norway.

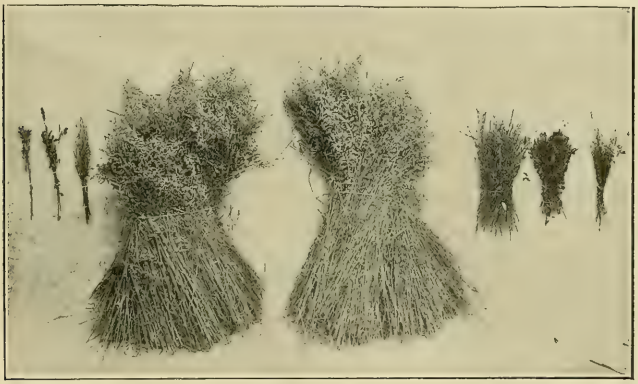
Practically all of the following addresses will be printed in the National Geographic Magazine, 1907–1908.

Friday, October 25, 1907—"The Tombs of Uaa and Tuaa and Queen Tiyi in the Valley of the Kings, at Thebes." Mr Theodore M. Davis, of Newport, R. I.

Friday, November 1, 1907—"The Northwest Passage." Captain Roald Amundsen, of Christiania, Norway. An account of the first successful passage around the north coast of North America from the Atlantic to the Pacific, a feat which had baffled the world for centuries. Illustrated.

Friday, November 15, 1907—"Peaks, Passes, and Glaciers." Prof. Charles E. Fay, of Tufts College, President American Alpine Club. With 100 illustrations from the unrivaled collection of mountain photographs by Signor Vittoria Sella. The Alps, the Caucasus, the Himalayas, and Alaska will be fully represented, and it is hoped that a few Sella photographs

Field to left sprayed; strip on right unsprayed (showing mustard plants in blossom three weeks after spraying)



On left, oats and weeds from three harvester bundles from treated plat; on right, same from untreated plat

Effect of spraying oat fields with iron sulphate solution for eradication of wild mustard. Wisconsin Station. Photos from U. S. Dep't of Agriculture

An Intermediate Type of Tomato, Nearly Seedless

Modification brought about by high feeding. Form, size, and quality the best

Large Type Seedless Tomato

Both types were developed by the Wisconsin Experiment Station at Madison. Photos from U. S. Dep't of Agriculture

Corn grown on undrained field

Corn grown on field with tile drains 70 feet apart

Corn grown on field with tile drains 40 feet apart. Originally the wettest portion of the area

These illustrations of experiments at the Wisconsin Experiment Station, at Madison, are from the U. S. Dep't of Agriculture

from the recent expedition of the Duke of Abruzzi to Mount Ruwenzori, in equatorial Africa, may be received in time for the address.

Friday, November 22, 1907—"Through the Deserts of Lower California, Mexico." Mr E. W. Nelson, of the Biological Survey. Mr Nelson will describe a recent trip through this unexplored section of America for the United States Biological Survey. The most remarkable desert vegetation in the world, seen in Lower California, will be shown on slides.

Friday, November 29, 1907—"The Native Peoples of the Congo." Dr Frederick Starr, of the University of Chicago. Author of "Strange Peoples," "The Truth about the Congo," etc. Illustrated.

Friday, December 6, 1907—"The Panama Canal." Illustrated with moving pictures of the work. Mr C. L. Chester.

Friday, December 13, 1907—"The Land of the Incas." Mrs Harriet Chalmers Adams, author of "The City that was Exchanged for New York," "East Indians in the New World," in the NATIONAL GEOGRAPHIC MAGAZINE for June and July, 1907. Illustrated.

December 14, 1907—Annual Banquet. The New Willard.

Friday, December 20, 1907—"The Second Peace Conference at The Hague." Hon. John W. Foster, formerly Secretary of State.

Friday, January 3, 1908—"The Geography of Mars." Percival Lowell, LL.D., Director of the Lowell Observatory, of Flagstaff, Arizona. Illustrated.

Friday, January 10, 1908—"Two Thousand Miles on Muleback through the Andean Wonderland." Hon. John Barrett, Director of the International Bureau of American Republics. Illustrated.

Friday, January 17, 1908—"A Camel Trip in the Salt and Sand of Chinese Turkestan." Mr Ellsworth Huntington, of Yale University, author of "The Pulse of Asia." Mr Huntington was a member of the recent expedition of the Carnegie Institution to Central Asia and Turkestan, and had unusual opportunities to study this interesting region. Illustrated.

Friday, January 24, 1908—"The Pelicans of America: An Account of Field Studies of the White Pelican in the Western States and in Northwest Canada, and of the Brown Pelican in Florida." Mr Frank M. Chapman, of the American Museum of Natural History. Illustrated.

Friday, January 31, 1908—"The Conservation of Our Natural Resources." Mr Gifford Pinchot, Chief of the U. S. Forest Service.

Friday, February 7, 1908—"South Africa: The Natives and the Mines." Mr Gardiner F. Williams, author of "The Diamond Mines of South Africa" and for many years General Manager of the De Beers Diamond Mines, Kimberley. Illustrated.

Friday, February 14, 1908—"The Deep-water Route from Chicago to the Gulf and its Connections." Hon. Joseph E. Ransdell, Member of Congress from Louisiana and President of the Rivers and Harbors Congress.

Friday, February 21, 1908—Hon. George Shiras, 3rd, of Pittsburg, has accepted the invitation of the National Geographic Society to address the Society on some of his experiences in hunting wild game with the camera. Illustrated.

Friday, February 28, 1908—"Holland's War with the Sea." Prof. J. Howard Gore. Illustrated.

Friday, March 6, 1908—"The Missions of California." Hon. Joseph R. Knowland, Member of Congress from California.

Friday, March 13, 1908—"Arizona—The Egypt of the New World." Mr Frederick Monsen. Mr Monsen describes not only the ancient ruins, but the country as it is today, with its Indian tribes, Spanish-Mexican settlements, and American towns. The wonderful Snake Dance of the Hopis will be shown.

Friday, March 20, 1908—"Perisa—Past and Present." Dr A. V. Williams-Jackson, of Columbia University. Illustrated with unusual pictures taken by Professor Jackson on extensive journeys through the ancient kingdom.

Friday, March 27, 1908—"The Geography of the Sea." Rear Admiral Colby M. Chester, U. S. Navy.

Friday, April 3, 1908—"Cathedrals, Mosques, and Temples of the World." Hon. O. P. Austin, Chief U. S. Bureau of Statistics. Illustrated.

INLAND WATERWAYS

Several technical meetings to consider our inland waterways, and particularly the Mississippi and its tributaries, are being arranged.

BOOK REVIEW

The Savage South Seas. Painted by Norman H. Hardy. Described by E. Way Eklington. Pp. 204, 6½ by 9 inches. Illustrated with 68 full-page pictures in colors. New York: Macmillan Co. $6.00.

The beautiful illustrations printed in this volume give an admirable idea of the people and life in British New Guinea, in the Solomon Islands, and among the New Hebrides. Mr Hardy lived for some time in that fascinating part of the world and presents a realistic picture of the rich color of the South Seas. The volume is one of a series published by Adam and Charles Black, of England, describing the different parts of the world, each volume in the series being illustrated with many colored pictures.

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Imagination and Geography.

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THE NATIONAL GEOGRAPHIC MAGAZINE

MADEIRA, ON THE WAY TO ITALY

By David Fairchild

THERE is something about an island in mid-ocean which is attractive, and if it is one of those mere specks on the blue field of a schoolboy's geography, so small that one's boyish wonder is that it was worth naming at all, it is almost irresistible.

There is one such spot of land, little more than twice the size of the District of Columbia, which has on it mountains 6,000 feet high, and which, although discovered before America and so thickly populated that there are 625 inhabitants to the square mile, has deep valleys that have scarcely been explored and inhabitants who have grown to old age without ever owning a looking-glass. On this spot of land the tropical banana and tree fern and the temperate-region oak and sycamore grow in sight of each other, and over every high wall great masses of flowering creepers are in bloom, and in the gardens masses of camellias and all sorts of flowering shrubs are perpetually in flower, frowned down upon by the snow-banks which cover the mountain peaks. This is Madeira, one of the most unique, one of the most beautiful, of all the volcanic mountain peaks that raise their summits above the surface of the ocean.

It is one of the quiet spots of the world and one to which tired souls from our great cities are turning for rest when the gray skies and the piles of sooty snow in the streets make the nervous life of a metropolis unbearable. No wonder it is one of the quietest places in the world, for, although the roads are paved with round beach pebbles, there are no horses shod with iron nor jolting wheels to remind you of the fact. This seems so small a thing to describe that one cannot conceive what a difference the absence of horses and carriages makes to one fresh from the streets of an American city teeming with them.

All vehicles in Madeira are on runners. If you go calling, it is in a bullock sledge, with canopy top and comfortable seats. If you move a bank safe or a steam-boiler, it is carried on a "stone boat" or sledge of poles, and you may have to get forty oxen to pull it. If you are in a villa on the hillside and want to get downtown, you take a running car and slide down over the cobblestones.

A ride in a running car is an experience to be ranked with the initial ride in an auto. You sit down in a comfortably cushioned seat in a low basket on wooden runners and brace yourself for the slide. Two strong men, each holding a guide rope, pull your car over a bag of grease to grease the runners, and then give you a running shove, and jump each on a

The Open Roadstead of Funchal

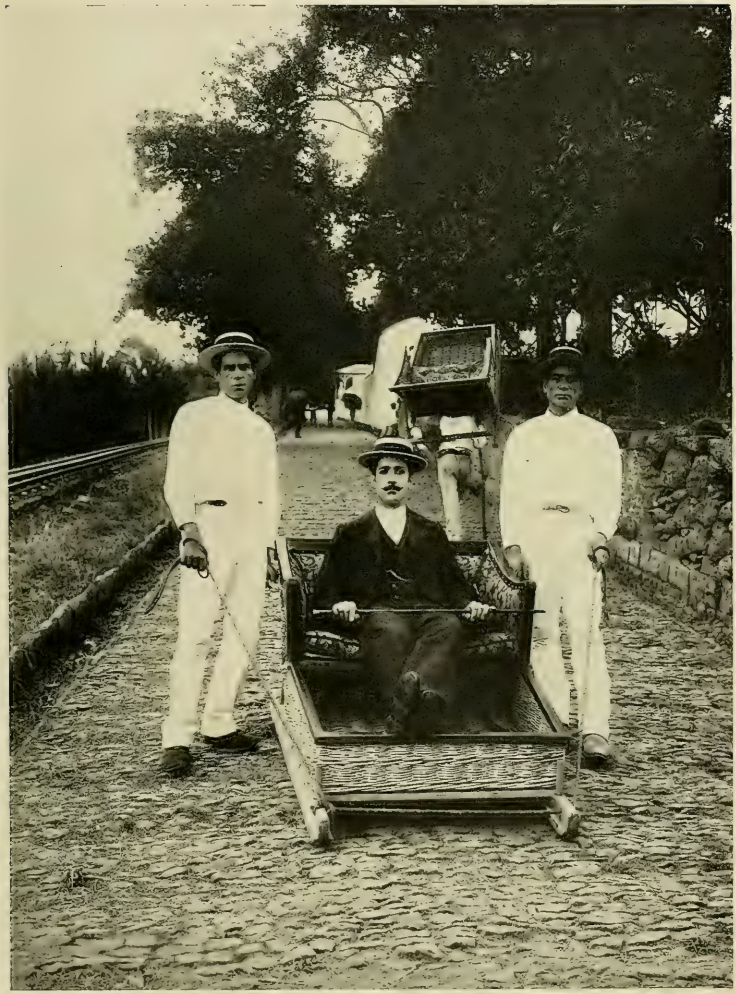
The port of call for steamers from South Africa, South America, Europe, North America, and the Mediterranean. One of the most cosmopolitan anchorages in the world

runner behind, as the car shoots down at break-neck pace over the cobblestones. The men yell, hens and dogs scamper, foot passengers cling close to the wall of the narrow street, the runners get hot and fill the air with odor of burning wood, as you shoot around sharp corners, down the busy thoroughfare, past gorgeous masses of flowering creepers, which hang over the walls of the private villas that border your street.

But oh the change when you get to the bottom! You are obliged either to walk or take a carro, slowest of all slow vehicles, drawn by slow-moving bullocks, squeaking and slipping over the stones, now shoved by main strength of the drivers away from the curb, now jolting over unusually bad bits of cobblestones, until at a snail's pace you reach your destination.

The Portuguese island of Madeira, though lying in the latitude of Charleston, is almost tropical in character. On the seacoast no freezes occur, and all but the ultra-tropical plants grow luxuriantly in the open air with ordinary care. The English residents have amused themselves with their gardens and have introduced a host of things that now add to the beauty of the island. They lay tribute, as it were, on the steamers as they anchor in the little roadstead from all parts of the world, getting from them all sorts of strange plants and animals, and they are sending to remote regions gifts of plants from their collections.

I know of no other place in the world where one can so sit under the shade of his own arbor and watch the steamers as they come and go to all parts of the world. This one weighing anchor for Pernambuco, just as the smoke of a South African cattle-boat is visible on the horizon. New York and San Francisco



The Running Car with Attendants

It is a quick, exciting way to come down, and seems more so after the tiresome bullock sledge ride up the hill. The car is carried up the hill on the shoulders of an attendant

A Steep Grade in Funchal

A cab stand on a corner on one of the steep thoroughfares of Funchal. Running cars for hire to coast down to the town

are of course more cosmopolitan than this, but you cannot appreciate it as you do when your neighbor at the table, a Russian from Odessa, stopping on her way to Rio, is replaced when she leaves by a Boer from the Transvaal on his way to London, and when in order to keep up a general table talk you must resort to three languages at least.

I can imagine no spot on the globe more favorably situated by nature than Madeira for the creation of a truly great private garden, and if there should be among those Americans who read these lines one who wants to see the most beautiful private estate in the world, he will find it, I believe, in the historic Palheiro, now the property of Mr. John B. Blandy, who belongs to one of the oldest of the many English families on the island. Twice, at long intervals, I have had the privilege of visiting Palheiro, and both times its charm and its remarkable variety of landscape and its incredible profusion of flowers have astonished me.

It does not lose its beauty even by comparison with the villas of southern and central Italy, or with the far-famed Cintra of Portugal. When you see an English manor-house commanding from an altitude of 2,000 feet a superb view of green mountain-side with the sea at its feet, a great avenue of sycamores, beautifully kept lawn, hedge rows, great masses of climbing roses, beds of violets, strawberry gardens, and English oaks, you are convinced that you are in England in June; but double rows of immense camellias covered with blossoms, giant acacias with their masses of pure gold flowers, groves of oranges and

The Carro of Madeira

Practically the only vehicle which can be drawn over the steep cobblestone roads of the island

lemons, convince you that you are in Italy, and its exquisite valley of tree ferns makes you sure that you must be in New Zealand, Hawaii, or one of the East Indian islands.

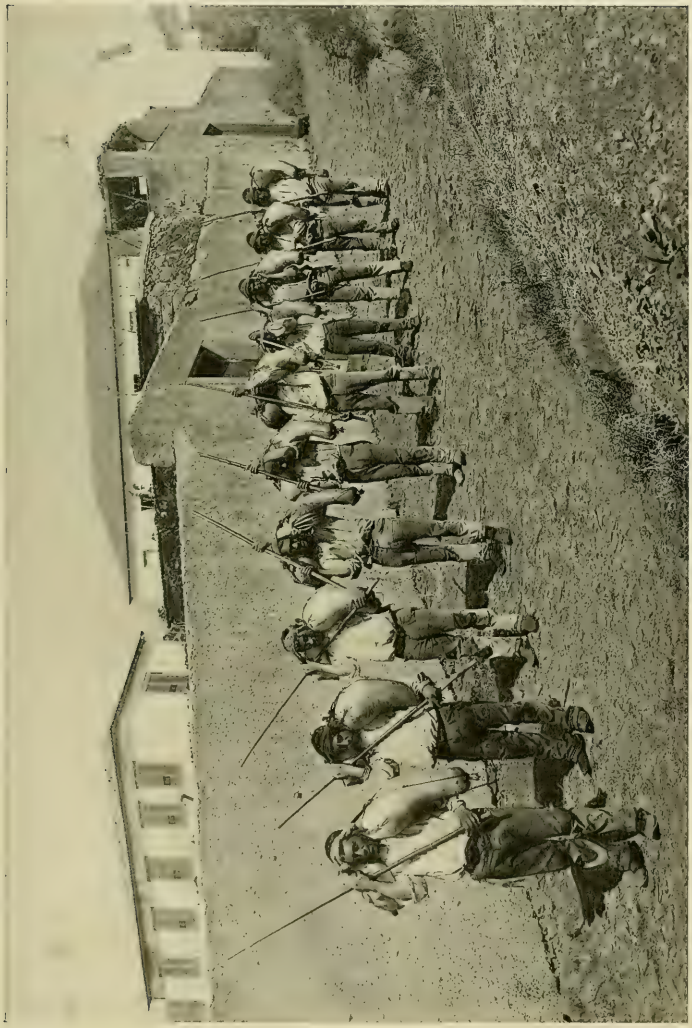
Summer, it is said, is the time to visit this wonderful place, and it is a pity that a misconception of the climate of the island prevents Americans from spending this season there, but even in winter, when the dispatches from home were telling of blockades of snow and interrupted traffic, we found Palheiro a dream of landscape beauty, and took away with us 26 kinds of flowers.

There are few places that give a greater perspective on our rushing, bustling civilization than this Portuguese island in the Atlantic, or which show more clearly the inevitable results of bad management from a political point of view. Did not every intelligent man one meets in Madeira criticise the government policy there might be reasons for not saying harsh things about it, but, as it is the constant talk of those who are borne down under it and suffer from it, there is no reason why American visitors who spend, as most of them do, only a day or two on the island should not understand some of the reasons why its people are so poor as a class, why illiteracy is so prevalent among them, and why this seeming paradise of beautiful and fruitful things is anything but ideal for those forced to live there and earn their living on it.

How is it possible that 150,000 people, who get their living from cultivating the soil, should keep abreast of the times when there is not a single industrial or agricultural school among them, and when the complaint common among those who send their children to the religious

Funchal, the One City of Madeira

Seen from the west, with the peak fort in the foreground and the snow-covered peaks behind



The New Madeira

Wine being carried in skins to the wine-cellars of Funchal

Scenery in the Grand Curral

Almost unexplored and inaccessible mountain valley of volcanic origin, whose sides are clothed with luxuriant semi-tropical vegetation at the bottom and with temperate region plants at the top

A Visitor to a Mountain Mission Station

One must either walk or be carried in a hammock over the steep mountain trails of the island

Madeirans in Gala Dress

These costumes are now rarely seen except in the western parishes

Photo from David Fairchild, U. S. Dep't of Agriculture

Madeiran Children

Wine Press Still in Use on the Island

schools of the country is that the children are only taught how to sing?

China has at the present time in this country over 120 government students, who are being educated at our agricultural and technical schools. Japan has long ago established her schools of agriculture and her experiment stations on a comprehensive scale, but Madeira remains still in a condition of apathy toward these fundamental things, which is truly appalling, and I predict that in ten years' time, unless she undergoes a revolution in this regard, she will be farther behind in the race than China is today.

How is it possible for a colony to prosper if its policies are directed on the mainland and subject to the political mix-ups of the mother country, which is interested only in the revenues she can get out of the impossible import duties she imposes?

Protection, designed in America to assist new industries until they get on their feet, has been resorted to by the Portuguese to keep alive such agricultural industries as should long ago have migrated to countries of cheap land and machine labor. If the government finances had been spent in exploiting the resources of the country by the introduction of crops that would pay, or in encouraging the cultivation of the delicious fruits and vegetables such as are already grown, a market could readily be formed in Europe and America, and this wonderful island would be rich instead of poor, and would have a host of agricultural monopolies instead of the one (Madeira wine), which has apparently seen its best days.

That new industries can be built up and thrive is perfectly evident from the start that has been made, mainly through the efforts of a few men, in the embroidery business. So profitable has this industry become that missionaries in the interior

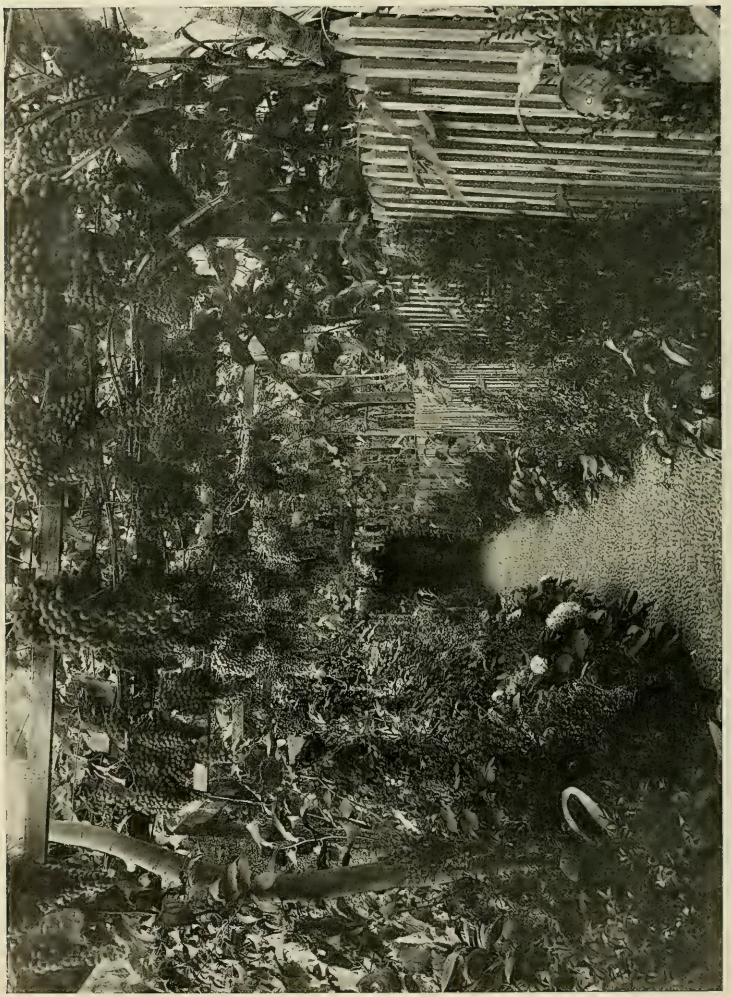
Where the "Old Madeira" Begins

A wine press of the old primitive type

of the island informed us that the housewives neglected their homes, injured their health, and ruined their eyesight in order to make the beautiful embroidery which every female tourist takes away with her. One firm, the Madeira House, sold $1,200 worth to one steamer load of Americans alone in a single day. Another dealer showed the writer a cablegram from the son of the governor of Para, who was just leaving Brazil for Paris, ordering $720 worth of embroidered petticoats.

In the old days, when Madeira wine was all the fashion and American clippers carried it around the Horn and back again to age it, the island prospered, and English firms made fortunes in a hurry. The island has a monopoly, an agricultural monopoly, such as France has in her truffles and her Bordeaux. Nowhere else in the world could the same wine be produced, and the wealthy of the great cities demanded it at any price. Times have changed, and doctors say that Madeira is bad for gout. The demand has decreased, fraudulent adulterated "Madeiras" have been illegally put on the world markets, and the vineyards still stand, but no great fortunes are now made in the wine business of the island.

For one who wants sight-seeing and things to do, Madeira is not the place to go. You cannot expect that thirty miles of mountainous country, so steep that horses cannot be used on it and over which you must either walk or be carried in canvas hammocks, will be the place to taken an automobile or have anything more exciting about it than is furnished by dangerous landing places on the coast or precipitous cliffs and ravines of volcanic rock; but there is a class of people to whom the wonderful scenery does appeal, who revel in the sunshine, the colors, the odors of the flowers, the quaint roadside scenes, and who are in-



The Grapes from which "The Old Madeira" is Made

Sledding a Load of Sugar-cane to Mill

All heavy loads are transported on narrow sleds drawn by oxen over cobblestone roads

Dragon Tree of the Island—a Century Old

Some of these trees rival the redwoods in age, and on the island of Teneriffe a famous one was recently blown down which must have been a seed before the birth of Christ

Cutting the Cane on one of the Terraced Miniature Sugar-cane Plantations

A Rest on the Way Home from the Spring

A Basket of Anonas on the Way to the Fruit Market

This fruit is one of the delicacies for which the island is renowned

A Typical Coast Village at the Foot of Precipitous Cliffs that are Terraced with Plantations to Their Top

Peasant Girls in the Interior Carrying Sweet Potatoes to Market

terested in the terraced hillsides, populated by simple peasants, living in thatched cabins. There are valleys thousands of feet deep, which are terraced to their summits in a manner quite as wonderful as anything you will see in Java or Japan. We Americans have not yet reached the stage where we must terrace and contour our hills, and it is a very useful thing to see how the almost perpendicular hillsides of this little island are all made to bear the crops which support human life, for it gives one a good idea of the margin of possible unoccupied land that still exists in America.

The problem that the Portuguese inhabitants of this colony have had to face is how to support on an island of 240 square miles, a great deal of which is in the air, so to speak, and absolutely untillable, a rapidly growing population, now numbering 150,000, or 625 to every

square mile. They have done it in one way, and, I suppose, the only way possible, a few generations ago, but if today this island were to be discovered anew, absolutely without human inhabitants, as it was originally, and it were left to Americans to populate it, the problem would be handled in quite another fashion.

By brute force and hand labor they have tried to do it, and, though the water-courses develop thousands of electric horse-power, they do not use it as they could to run their mills nor to encircle the island with an electric railway. They prefer that it shall cost more to bring a load of timber from a few miles in the interior than to bring it all the way from Norway, and in this, perhaps, they are no worse than Americans, with their short-sighted policy of poor country roads. But their terraces are marvels of industry, and one stands amazed before them as before the giant ant-hills of Africa or the Indies.

Little by little, just as the ant-hills are made, these terraces are fastened to the cliffs by a race of physically overworked people, who are happy in a religion that keeps them in the grossest ignorance and in those physical pleasures that are common to the savage and the civilized alike. Instead of growing in intelligence, these emigrants—hybrids of Moorish and European immigration—have been forced by the pressure of a hard day-by-day struggle for mere food and fire to lower and lower levels, until today they are on a plane with some of the so-called savage races, as far as their food habits are concerned, though, of course, far above these in their instinct of labor. The island is now so overpopulated that the young men are getting away to Hawaii and the Argentine, where money is to be made. In a sense, Madeira is becoming an admirable place for the creation of cheap but industrious field labor. In a single steamer over 1,000 of these field hands left for Hawaii to work in the sugar estates there.

If there were adequate provision for educating these peasant's sons, it would be hard to find conditions more likely to instill into them the instinct of industry and at the same time develop good, strong bodies than those furnished by the simple mountain life of the peasant of Madeira.

A SIMPLE METHOD OF PROVING THAT THE EARTH IS ROUND

By Robert Marshall Brown

State Normal School, Worcester, Massachusetts

My attention was directed a year or so ago by Prof. W. M. Davis to certain experiments on the curvature of the earth performed by Mr H. Yule Oldham, of King's College, Cambridge, England, on the old "Bedford Level." It was suggested to me at the time that Lake Quinsigamond offered exceptional advantages for the repetition of these experiments. I have not been able to find Mr Oldham's report on his experiments, and such references to them as I have seen have not furnished me with any idea of the methods pursued by him. In one sense, then, my experiment is not a repetition. The object was the same, the methods were in the main similar, but the apparatus probably differed.

Nearly every one is familiar with the proof of earth sphericity deduced from the disappearance of a ship at sea. This proof, in part because of its submittance to simple diagrammatic representation on a blackboard or on paper and the sim-

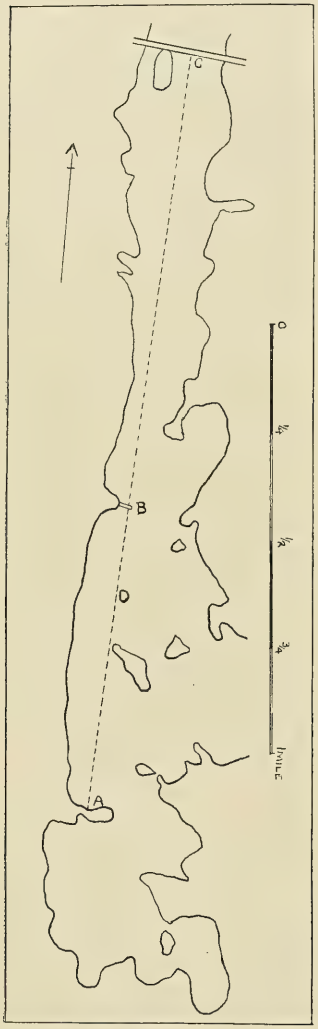


Figure 1

plicity of the illustration on a globe, has gained precedence over others even in a land where but a small percentage of the people at school ever have a chance to experience the real demonstration. To those who have the opportunity to observe for themselves this phenomenon, the unaided eye does not on most occasions yield very satisfactory results.

The experiment which forms the theme of this paper is of a nature similar to the ship-at-sea proof of rotundity of the earth and differs most in the limits of the range. The writer makes no claim to originality as far as the fundamental proposition is concerned. It has been mentioned, more from a theoretical standpoint, however, in books on astronomy and geography for years. He desires to show how simply the experiment may be performed in regions where the proper conditions prevail. It may be done wherever a level of a mile or more is to be obtained. The first choice in locality falls on an inland lake, apart from tides and swells, where on a calm day a level and unchanging surface is available. It is necessary to have three stations, one intermediate in position, so that a salient or an island is a requirement. This same experiment may be done upon a reasonably level area by erecting rods whose heights are carefully determined by a surveyor's leveling instrument.

Lake Quinsigamond, the field of the experiment, is about 5½ miles long and from one-eighth to one-half mile in width. It is situated along the eastern boundary of Worcester, Mass. The lake, like most New England lakes, is the resultant of the blocking of drainage by the deposit of glacial drift. Many islands break the water surface, and the shore line is somewhat irregular. Figure 1 is a map of a portion of the southern end of the lake. At A, a board two feet square, mounted on an ordinary chart standard, was located. The board was divided vertically into two parts. The upper part was covered with black paper. This yielded a distinct horizontal line at the boundary of the paper and the board.

Figure 2

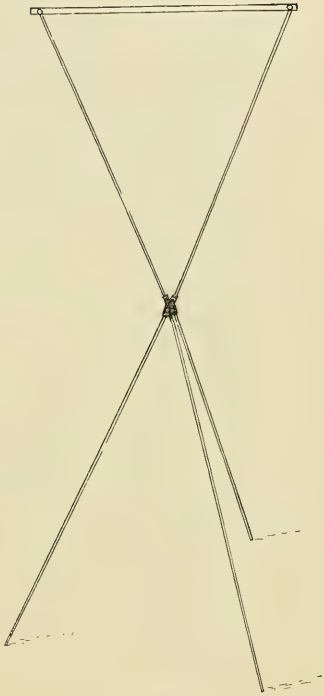


Figure 3

In setting up this apparatus the legs of the standard were driven into the gravel at the water's edge, the board being over the surface of the water. Plumb lines were dropped from the ends of the horizontal line, and both ends were placed at the same height above the water surface (in this case, four feet two and one-half inches). Figure 2 is an illustration of this apparatus.

At B (figure 1), near a wharf which extends into the lake, a bar was erected. This bar (figure 3) was also mounted on a chart standard. It was set up in such a way that it was parallel to the horizontal line of the first piece of apparatus, and it was made level by dropping plumb lines from the ends of the bar. The bar was covered with white paper. It was an inch in diameter, and its center was placed four feet two and one-half inches above the surface of the lake. At C a telescope was mounted on a third standard. The telescope was a two-inch glass, and it magnified about twenty-five diameters. The axis of the telescope was placed at four feet two and one-half inches above the water surface. The horizontal line of the apparatus at A, the middle of the bar at B, and the axial line of the telescope at the point of support were at the same distance above the

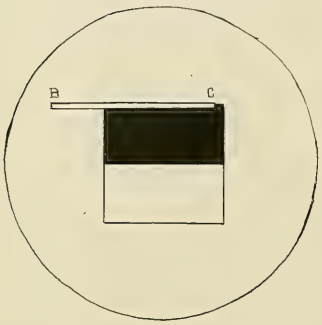


Figure 4

water of the lake. In sighting (C to A on map) at the horizontal line of the standard placed at A, the bar appeared in the field of view projected on the board. The bar did not coincide with the horizontal line, but appeared at the top of the black surface of the board. The view through the telescope is sketched in figure 4. This upheld the expectation with which the experimenter went into the field. The explanation is so obvious as not to need a long dissertation. Reference to figure 5, which represents a cross-section of a portion of the earth, may be helpful. The points A′, B′, and C′, which were equally distant above the water surface, may be considered as equal extensions of three radii; the circumference through A′, B′, and C′ is concentric to the earth's circumference. The chord A′–C′ must intersect the extended radius BB′. The chord A′–B′, extended, will pass out of the circle and cut a still farther extension of CC′ at C″.

In order to check the experiment another standard similar to the one pictured in figure 2 was erected at C. The horizontal line was placed at four feet two and one-half inches above the water surface. A return was then made to A. The bar at B was inspected and its height measured again, and no change had taken place in its position. At A the height of the horizontal line was measured again, and showed no disturbance. From A, a sighting was made on the board at C. The bar again appeared in the field of vision, and again it was projected against the top of the black paper on the board. In returning to A, I had reached the conclusion that inasmuch as the distance B-C, 5,660 feet, was greater than the distance A–B, 3,740 feet, the displacement of the bar as seen from A projected on the board at C would be greater than the displacement on the board at A as seen from C. To find the bar projected against relatively the same positions suggested an error in my measurements. Each piece of apparatus was measured again, and found to have been at the desired distance above the water. My difficulty was removed on measuring the boards. The black surface of the board placed at C was twelve inches high, while that at A was ten and one-half inches.

No attempt was made at quantitative work. It is the plan to obtain data for finding the size of the earth. New stations will be selected, and the position of the bar will be located more nearly half way between the terminal points.

The writer commends a trial of this experiment, wherever conditions permit, to a teacher for a class exercise or to any individual for his own enjoyment. It is simple and it is convincing.

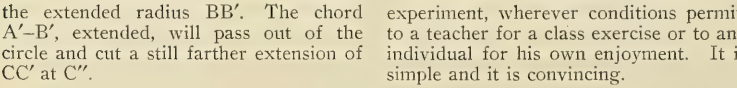


Figure 5

Photo by Rev. T. S. Wyncoop, of Allahabad, India

Piling Sunbaked Bricks in India

The wages of these women are 3 cents a day and their hours from sunrise to sunset

Photo by John A. Fleming, Carnegie Institution

Indian Woman and Child of Guatemala

The picture is particularly faithful in showing the patterns of cloth made by the Indians; this native-made cloth is used almost exclusively among the natives outside of the cities.

A Wallapai Indian Girl of Arizona with a Basket of Native Manufacture

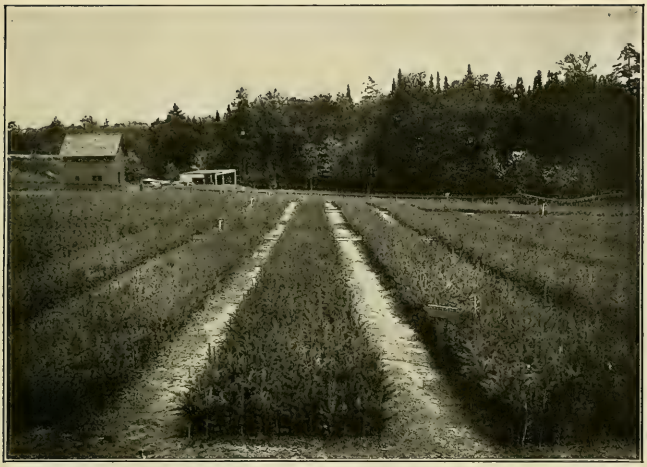
Into the pattern of these baskets the Indians weave their myths and family history, prayers, etc.

Crop of Onions on Reclaimed Salt Marsh, Revere, Massachusetts

Photos from U. S. Dep't of Agriculture

Crop of Hay on Diked Meadow, Marshfield, Massachusetts

The tidal marsh lands along the Atlantic coast are estimated to have an area of about 1,000,000 acres. As part of these lands are near large cities, and would have a very high value for market gardening and the raising of fruit if they could be protected from the invasion of salt water and relieved of the water draining onto them from higher lands, the Department of Agriculture is helping to find a practicable method for making them useful.



Scotch and white pine, 5 years old, in the Lake Clear plantation

Photos from U. S. Dep't of Agriculture

Successful Examples of Planting Denuded State Land

Transplant beds of nursery at Saranac Inn, New York. Norway spruce, 3 years old, in the foreground; Scotch pine to the left

Photos from U. S. Dep't of Agriculture

Early Versus Late Planting of Cotton in the Control of the Boll Weevil

The upper illustration shows a cotton field planted late and yielding nothing. The lower illustration shows a field on the opposite side of the turnrow on same plantation, planted and treated in accordance with directions of the Bureau of Entomolgy, and yielding three-quarters of a bale per acre.

THE MODERN ALCHEMIST

By Hon. James Wilson, Secretary of Agriculture

The following article has been abstracted by the Editor from Mr. Wilson's report as Secretary of Agriculture for 1907. No finer instance of the unselfish ingenuity and practical inventiveness of the American race can be found than what Secretary Wilson and the hundreds of trained specialists of the Department of Agriculture and of the Experiment Stations are doing to make gold from our soil for the American people.

THE year 1907 has been a year of untoward conditions, requiring all the industry and skill of the farmers to grow an average crop. They have struggled not only with an erratic season, but with a scarcity of help in all the states and territories of the Union.

Such a year, with its hard winter—summer weather in March and late cold spring—gives exceptional emphasis to the wisdom of this department's policy of diversifying farm products and of establishing new crops. A general crop failure in a field as large as the chief part of the temperate zone of a continent must be a rare occurrence.

No general crop failure afflicts the farmer this year, not even within small areas. The production of the farms, all things considered, is well up to the average of the previous five years in quantity, while its value to the farmer, as now appears at this annual day of reckoning, reaches a figure much above that of 1906, which by far exceeded any previous year's wealth production on farms.

Out of the farming operations of 1907 the railroads will get an average haul of freight, and foreign countries will take a heavy excess above home consumption. The farmer will have more to spend and more to invest than he ever before had out of his year's work.

THE DESERT FEEDS THE CITIES

When the Department of Agriculture brought durum wheat to this country from Russia and Africa during 1899 to 1902, the seed was sown that formed practically the entire foundation of the present crop of durum wheat. At a cost of $10,000 in the beginning, a crop worth $30,000,000 now grows in regions of low rainfall, where in the day of stock ranges the steer roamed on 20 acres to find his cud. This crop has encroached on the home of the prairie dog and of the cactus. It has spread throughout a wide strip of country, extending from northern North Dakota to southeastern New Mexico and northwestern Texas. It is a common crop in Montana and Idaho and in parts of Washington, Oregon, and Utah.

Durum wheat has entered into home industries. To a considerable extent it is mixed with other wheat in making flour for bread. It is promoting the manufacture of macaroni and kindred paste products in this country and is prepared as a breakfast food. It is the grain through which the desert feeds the cities of the east at home and abroad.

As an export crop durum wheat has become prominent. In 1905 Europe took nearly 10,000,000 of the 20,000,000 bushels produced; in 1906 about 20,000,000 bushels of the crop of that year.

Last year two-thirds of the exports went to Mediterranean countries. The former sheep and cattle ranges sent macaroni material to Marseilles, Naples, and Venice; to Greece, Spain, and the countries of western Europe; and even to the old homes of durum wheat—northern Africa and Russia. Shipments of this wheat were made to 43 ports in Europe and Africa named in trade reports of the collectors of customs, and to other ports unnamed.

With an average production of about

15 bushels per acre, durum wheat this year covered an area of over 3,000,000 acres, many of them valueless for agricultural purposes before the advent of this new crop. Its value to the farmer is over twice the entire cost of the Department of Agriculture during the current fiscal year, including the Weather Bureau, the costly meat inspection, and the Forest Service.

RAPID DEVELOPMENT OF BEET SUGAR

The beet-sugar industry has grown rapidly under aid and encouragement from the Department of Agriculture and the experiment stations and with favorable legislation by Congress and several state legislatures.

About 560 short tons of beet sugar were made yearly from 1879 to 1887; in 1891 the quantity was 6,000 short tons; in 1906, 483,000 short tons, and in 1907, 500,000 short tons.

As an acquisition to agriculture, much may be said in favor of growing sugar beets for the factory. Tillage must be of the best and the soil fertile. The pulp of the beets, after the extraction of the sugar, is relished by live stock. The crop is grown under factory-contract conditions, and the farmer knows upon what he may depend for profit.

Sugar factories occupy a belt across the continent in the sugar-beet zone and a belt from Washington to Arizona along the Pacific coast.

In 16 states there were 64 factories in 1906, with a capacity of working 49,500 tons of beets daily. In the western states, the growing of sugar beets has proved to be so remunerative that sugar-beet farms increased in value $42.49 per acre from 1900 to 1905, as determined by special investigation by the Department of Agriculture, or from $99.47 per acre in 1900 to $141.96 in 1905.

To the fostering of this industry by nation and states, it has responded by increasing the value of its production 543 per cent in nine years. The factory value of the refined sugar made in 1899 was $7,000,000, and in 1907, $45,000,000.*

One-third of the value of the beet sugar made this year would be enough to pay the cost of the Department of Agriculture during the current fiscal year and the national expense of the sixty experiment stations of contiguous United States when they shall have received the ultimate appropriation of the Adams act.

LUXURIANT ALFALFA

Alfalfa, that extraordinary plant for producing wealth and doing wonders to farms, is occupying an important place in the plans of the Department of Agriculture, the experiment stations, and the agricultural colleges. Through their efforts largely it has rapidly gained success in cultivation throughout a vast area. The value of the crop as hay this year is supposed to be $100,000,000, and if the plans and efforts now under way to promote its extension receive a reasonable reward, the value of the future crop will be several times the present amount.

This forage plant is a chemical laboratory in which nitrogen is taken from the air. It is a soil improver of the highest merit. As a flesh-forming feed for growing live stock, and as a milk and egg producer, it is unexcelled by any plant of large production.

It grows 2½ tons of hay to the acre as an average for the whole country where it is grown, or twice the average for all kinds of hay, and, besides this, is more nutritious than other hays.

The cultivation of alfalfa has been pressing eastward until now it has established itself as far as the longitude of eastern Kansas, except in southern Texas. It is established in some areas still farther to the eastward—in spots in Arkansas, in southern Wisconsin, northern Illinois, and northern Indiana, in the limestone regions of Kentucky and Tennessee, and in the southeastern corner of Michigan.

*The raw cane-sugar mill production of 1907 is estimated at 389,000 short tons, with a factory value of $28,000,000, the year 1904 alone exceeding this amount.

This plant is semi-established in Minnesota, Iowa, Missouri, Ohio, and is making its way in Illinois and Indiana. Elsewhere the growing of this plant is mostly experimental, but with promise of success.

Further extension of alfalfa-growing on large areas is a prize that will be worth hundreds of millions of dollars yearly; and it will be won. What has already been secured aided in the rescue of the farm production of this year from the disasters of the weather.

VALUE OF THE DEPARTMENT'S WORK IN DOLLARS

The foregoing striking features of the results of crop introduction and extension within the last few years are some of the illustrations of the wisdom of the great movement of the Department of Agriculture, of the experiment stations, and of the agricultural colleges, to fortify and buttress the agriculture of the nation against misfortune, and to give to it a sort of insurance by multiplying the sources of success. This policy has done much to keep the production of 1907 not only from disaster, but, all things considered, actually to keep it up to an average of recent years.

It is difficult to express in dollars the value of the work of the Department of Agriculture to farmers, and therefore to the nation, but an attempt to do so was made last winter for the Committee of the House of Representatives on Expenditures in the Department of Agriculture, which made a total of $232,000,000.

Fundamentally the work of the department is concerned with the production of wealth, as by increasing a crop yield per acre by plant breeding; or the preservation of wealth, as by suppressing insect and fungous pests; or by enabling farmers to make a fair sale of their products, as by promoting coöperative selling or by giving to the public information of the size of a crop in order that demand may be fairly adjusted to supply.

FABULOUS WEALTH OF CORN

Four-fifths of the world's production of corn, as nearly as can be determined, grows in the United States, and in the world's international trade in corn this country contributes one-third to one-half of the exports, not including the products of corn-fed animals.

Corn is the chief of crops and exceeds every other prominent agricultural factor of national prosperity. It is a human food and more especially a live-stock feed, with striking results. It is one of the great motive powers in the food of an energetic age. The starch of corn becomes the fat of the hog and the "finish" of the steer. No meat products are so much in demand in international trade as animal fats and oils.

Fear of a failure or a large degree of failure of the corn crop this year diminished after midsummer and at last the harvest secured 2,553,732,000 bushels—a production that is almost exactly the average of the crops of the preceding five years. There have been three larger corn crops—those of 1899, 1905, and 1906.

In value the corn crop of this year is much above the high-water mark of 1906, On the assumption that the crop will be sold by farmers at an average price not below the present one, its value is estimated to be $1,350,000,000, or 26 per cent above the average value of the previous five crops. Four crops before had exceeded one billion dollars in value.

The farm value of the corn crop of eight such years as 1907 would pay for duplicating every mile of steam railroads in the United States and pay for their costly terminals, rolling stock, and all property. In thirteen years it would replace the present banking power of this country in banking capital, surplus, deposits, and circulation, and in seventeen years it would replace the banking power of the world.

OUR COTTON UNRIVALLED

The farm value of the 1907 crop of cotton and its seed is estimated to be from

$650,000,000 to $675,000,000. Its farm value is probably a little below that of last year's crop. Otherwise it will be the most valuable cotton crop ever raised in this country and 7 per cent above the average farm value of the crops of the previous five years.

The year was a trying one to cotton from planting time to nearly the end of the summer, but even under adverse conditions a crop has been produced that will be sufficient, with the surplus of last year, to meet the requirements of spinners until the next harvest.

The fears of a cotton famine that followed the low production of this country in 1901 have not been justified, and in the meantime efforts to make European spinners partly independent of the upland cotton of the South by aiding the growing of "colonial" cotton have not made themselves felt.

Among the strong points of advantage possessed by this country's cotton is the low cost of transportation to market. Recent investigations by this department indicate that the average cost of transporting cotton per 100 pounds from farm to local shipping point is about 16 cents; from local shipping point to seaport, about 40 cents, and from seaport to the United Kingdom, about 32 cents, the total being only 88 cents per 100 pounds, or less than a cent a pound.

TOTAL WEALTH PRODUCTION IN 1907

Wealth production on farms in 1907, as expressed in value, transcended the high record of 1906, which was itself much above the highest amount before reached. In arriving at the total the farm products of the year are estimated in value for every detail presented by the census and at that point in production at which they acquire commercial value.

The grand total for 1907 is $7,412,000,000. This is $657,000,000 above the value of 1906, $1,103,000,000 above that of 1905, $1,253,000,000 above that of 1904, $1,495,000,000 above that of 1903, and $2,695,000,000 above the census amount for 1899.

The value of the farm products of 1907 was 10 per cent greater than that of 1906, 17 per cent over 1905, 20 per cent over 1904, 25 per cent over 1903, and 57 per cent over 1899.

During the last nine years wealth, estimated as above explained, was created on farms to the fabulous amount of $53,000,000,000.

Besides the crops, there were farm dairy products in 1907 which nearly reached $800,000,000. The price of butter increased 4¾ cents a pound over 1906 and of milk three-fourths of a cent a gallon.

More than $600,000,000 must be regarded as the value of the poultry and eggs produced on farms in 1907. The amount may easily have been larger. This industry has advanced at such a rapid rate that no arithmetic can keep up with it. The farm price of eggs in 1899 was 11.15 cents per dozen as an average for the United States; in 1903, 12.37 cents; in 1904, 17.2 cents; in 1905, 18.7 cents; in 1906, 17 cents, and in 1907, 18.2 cents.

Dressed poultry in New York sold for 10.78 cents per pound wholesale in 1899, for 12.97 cents in 1903, for 12.57 cents in 1904, for 13.36 cents in 1905, for 13.2 cents in 1906, and for 14.9 cents in 1907.

MOST OF OUR FOREIGN CREDIT PROVIDED BY FARMERS

The farmer provides the great bulk of the foreign credit which other classes of persons draw upon in the contrary movement of credit against this country.

The balance of trade in farm products in favor of this country in 1907 was $444,000,000, an amount that has been exceeded in only four years—1898, 1899, 1901, and 1902. In all other products the trade of 1907 produced a balance of only $2,500,000 in favor of this country.

In eighteen years beginning with 1890

the farmers have not failed to secure a balance of at least $193,000,000, the low amount of 1895. The great aggregate of the 18 balances in the trade in farm products is $6,500,000,000, while the trade in other commodities during the eighteen years resulted in a grand adverse balance of $456,000,000.

So a great stream of wealth has constantly been sent from farms to foreign countries to offset the adverse balance of trade in commodities other than agricultural; to pay the ocean freight costs on imports conveyed in foreign-owned ships, and to pay the interest, dividends, and principal on investments in the United States by foreigners. It is the farmer who has sent credit to expatriated Americans; it is he who has provided the immigrant with millions to send every year to the loved ones in the old countries; and, if there is still any credit to dispose of, the farmer has provided the American traveler in foreign countries with his pocket money.

WORLD'S RECORD FOR HIGH FLIGHTS OF KITES

The creation of a research observatory at Mount Weather, Virginia, and the gathering together of a highly trained staff of men for the study of meteorological problems marks an important epoch in the development of meteorological science in this country. One of the first results achieved by that staff was the sending of meteorological instruments, by means of aëroplanes, to a greater altitude than has hitherto been accomplished. On October 3, 1907, the world's record for high flights was exceeded. On that day eight kites, in tandem, carried the meteorograph to an altitude of 23,111 feet above sea-level. Daily observations of upper-air conditions have been continued for over three months in succession, practically without interruption, and it is probable that this record will be maintained indefinitely in the future. The observations obtained in this manner are placed before the forecast official in Washington each night. The latter is thus informed of the vertical gradients of temperature and the direction of the wind for altitudes varying on the average from one-half mile to two miles. These facts are of great importance in the making of forecasts for the Middle Atlantic and New England States and for the elucidation of many problems of the upper air that hitherto it has been impossible to study.

In the past forecasts of the weather, as is well known, have been based entirely upon the existing horizontal gradients of pressure and temperature at the surface of the earth. The formation of charts showing the distribution of temperature with increase of elevation above the earth's surface, which is now for the first time possible in our weather service, so graphically tells the story of the rise and fall of the thermal levels that the layman is able to comprehend their significance. It is apparent that when a comparatively deep stratum of abnormally warm or abnormally cold air persistently overlies a region the action of a moving cyclone or anticyclone on the weather experienced at the bottom of the atmosphere will be materially different from that which would be experienced were the upper air at a normal temperature.

The significance of these data from the view-point of the forecaster is not yet fully understood, but certainly they present a fund of information that will be studied with profit by those whose duty it is to add to our limited knowledge of the science that must precede the art of weather forecasting.

The upper-air work at Mount Weather is thus described in detail because it is the one line of inquiry that at present holds out the greatest promise of immediate utility. The results already secured are deemed to be of such value that it is hoped means will be provided for the diligent prosecution of other lines of research work.

BREEDING FOR NEW ANIMALS

The work in the breeding of American carriage horses, in coöperation with the

Colorado experiment station, is progressing satisfactorily. During the fiscal year 11 foals, the progeny of selected parents, were dropped—2 males and 9 females. No additional horses were purchased.

The work in breeding Morgan horses, which is being carried on in coöperation with the Vermont experiment station, has been greatly extended through the generosity of a public-spirited citizen of Vermont, who donated to the department a farm of 400 acres near Middlebury, to be used in these operations. There were in the Vermont stud on July 1, 1907, 1 stallion, 9 brood mares, 1 two-year-old filly, 8 younger fillies, and 1 weanling colt.

There is great need of a breed of sheep suitable to the range conditions of the West, the requirements being for sheep that will yield a profitable clip of wool, produce good mutton lambs, and stand flocking in large numbers. It is believed possible to combine these characteristics in one breed, and with this idea in mind an experiment was begun in the fall of 1906 in coöperation with the Wyoming experiment station. Eighty-nine ewes and four rams have been purchased for foundation stock.

Experiments in developing a milking strain of short-horn cattle have been begun in coöperation with the Minnesota experiment station and with nine Minnesota breeders, the latter having agreed to allow their herds to be used and to manage them according to instructions of the department and the station.

MILK OF WASHINGTON, D. C.

A feature of the year's work was the investigation of the milk supply of Washington, D. C. Nine hundred and sixteen dairies and dairy herds, with 16,446 cows, were inspected and rated in accordance with a score card prepared by the Dairy Division. With few exceptions, the conditions found were very unsatisfactory, the average score being only 45 out of a possible 100. This result may be considered as giving some indication of the quality and condition of the milk supply of the country, as it is believed that the conditions around Washington are no worse than those existing around other large cities.

The department is taking an important part in the general movement for a better milk supply, and assistance in that direction has been rendered to a number of cities.

PREVENTION OF "PEACH BLIGHT"

For a number of years it has been a problem with pathologists to find some successful way of treating the peach with fungicides in order not to injure the foliage. Some of the standard fungicides often cause complete defoliation. For this reason it has been found difficult to control a number of serious diseases affecting the peach by any of the ordinary treatments. This year it was discovered that a sulphur wash made by combining lime and sulphur, with no other heat than that produced by the slaking of the lime, gave a preparation which was not injurious to peach foliage and which prevented the scab and reduced peach rot to 10 per cent on the sprayed trees, whereas unsprayed trees had 75 per cent of the disease. This fungicide, further, completely prevented the leaf-spot fungi and produced no injury whatever, either to foliage or fruit. While this preparation has been previously used in winter, when the trees were dormant, this is the first time it has been tried on trees in active growth, with the success as indicated.

Last year mention was made in this report of a very serious disease of the peach in California, popularly known as "peach blight." Experiments were conducted during last fall and winter for the control of this disease, and, as the result of this work, it was found that the disease could be completely controlled by the use of standard Bordeaux mixture or lime and sulphur wash applied early in the fall, about the time of the first rains. The methods recommended by the department were widely used in California the past season with complete success, and we have been reliably informed that the treat-

ment has meant many millions of dollars to the peach industry of that State.

ORIENTAL PLANT EXPLORATIONS

China has proved a fruitful field for this work, and an explorer has been kept there constantly during the year. His work has taken him through the little-known regions of southern Siberia, the border of Manchuria, the excessively dry mountains west of Pekin, and through the fertile country between Pekin and Hankau. This explorer has sent to this country over a thousand living seed and plant specimens for trial. Among these are promising blackberries and currants from northern Korea; a north Manchurian apple; a collection of 24 named pears from north China; several bush cherries and plums and peaches from northern Siberia — perhaps the very northern limit of peach culture in the Orient; drought-resistant alfalfas; dry-land rices; staple foods of the native Manchurians, but unknown to us, from regions where the climate is similar to that of the Dakotas; and a cherry noted for remarkable earliness, ripening its fruit in mid-April in northern California. Besides these, the explorer has sent in a large number of ornamental plants which our nurserymen have been for some time anxious to secure, because of the unusual hardiness of these north China species.

NEW ALFALFAS AND CLOVERS

During the year an explorer has returned with seeds of the yellow-flowered Siberian alfalfa, and these seeds have grown into promising plants in the severe climate of the Northwest. The results of their trial will determine whether we shall import large quantities of the seed, as we have previously done with the Turkestan and Arabian alfalfas, both of which continue in their respective territories to gain in popularity. The Toten clover, also secured from Norway, where it is cultivated for its extreme hardiness, is being tested in the Dakotas.

For the rice growers of the South there have been introduced 46 varieties from different parts of the world, among them the one-hundred-day rices—early sorts, which, in Japan, give crops when ordinary rices fail.

The fruit-growers of our tropical possessions have had their interest in mango growing stimulated by the fruiting of some of our East Indian fine-flavored varieties. All the local nurseymen are ready to sell in quantity several of the introductions of the department, and not only are the experiment stations of Hawaii and Porto Rico taking up this fruit, but, what is especially important, private plantation owners are planting out orchards of our introduced sorts.

The growing scarcity of wood for manufacturing purposes has led the department to make some extensive investigations of bamboo culture in Japan and other countries. Already a number of varieties have been introduced and steps have just been taken for the inauguration of a considerable number of plantations of these important plants in different parts of the South.

During the spring and summer of 1907 a new date garden was established at Indio, California. A new date garden has also been established at Laredo, Texas, in a part of the Rio Grande Valley where the climate in spring and early summer is the hottest in the United States. It is believed that good dates can be grown in this part of Texas. The date palms in the Mecca garden, now from two to three years old, have begun to fruit freely, and the famous Deglet Noor and a number of other choice varities have ripened perfectly, in spite of the fact that the season has been unusually cool. During the past year much interest has been taken in the planting of seedling date orchards in the hope of securing new varieties better adapted to American climatic conditions. Altogether some 150,000 date seeds have been planted in coöperation with growers in California, Arizona, and Texas. These growers will receive one or two offshots from imported date palms for every 250 date seedlings set out in proper form.

DROUGHT-RESISTANT OLIVES

With the opening up of territory in the Southwest, demands are being made upon the department for information regarding the best crops for this extensive dry-land country. Southwestern Texas is a promising field, especially in the matter of arborescent crops. Investigations made in southern Tunis by the department have revealed the existence of extensive olive orchards in that region carried on where the annual rainfall is sometimes below 10 inches for several consecutive years and where the annual evaporation is over 100 inches. The olive grown under these extreme dry-land conditions has been imported and shows every promise of doing well in some parts of Texas and Arizona.

Studies made the past year in the Southwest have revealed the existence of a number of species closely allied to the almond and peach of the Old World. Several of these occur in very dry situations and one is distinctly of promise as a stock upon which to graft almonds, apricots, and other stone fruits for culture on unirrigated lands. Another species growing in central Texas bears a very early ripening fruit of fair size which is said to be of delicious flavor. Plants of this "wild peach" have been secured and selections will be made with the hope of obtaining a native drought-resistant peach-like fruit which can be grown in regions where peaches do not now succeed.

NEW WEALTH FOR THE SOUTH

One of the most important forage crops is the cowpea, which is to the South what clover is to the North. During the year extensive investigations have been made of this crop, the principal object being to secure cheaper and better seed so as to bring about a great increase in cowpea culture. Special machinery has now been developed for harvesting the upright-growing varieties. The need is for good varieties producing small, hard seeds that will not crack and that retain their vitality for more than one year. Many new varieties have been secured from foreign countries and a large number of others developed by hybridization, some of which show great promise.

The rice-growers of the South, especially in Louisiana and Texas, have long felt the need of a legume that might be grown in rotation on their rice lands. The department has been successful in introducing a specially adapted variety of soy bean used on the rice lands of central China. These soy beans have been tested and give every promise of filling the need perfectly. Three varieties have been secured, all very similar and characterized by great leafiness, fine stems, and large size, becoming 6 feet high, so that they produce large crops of excellent hay. Thus we have a combination of crops which will, we hope, do for the rice-growers what clover does for the wheat fields of the North, serving not only as a valuable soil improver but as an important forage crop as well.

Numerous attempts have been made to grow Egyptian cottons in this country. During the year gratifying progress has been made in this work, Egyptian cotton of the Mit Afifi variety having been grown quite successfully under irrigation at Yuma, Arizona. One selection has yielded at the rate of 500 pounds of lint per acre, which is unusually high for Egyptian cotton in this country. Some of the improved upland strains have also given equal and even superior yields in this region. The upland varieties that seem at present most promising for this important agricultural section of the Southwest are the Southern Hope, Sunflower, and Columbia, the latter being a variety improved by the department in South Carolina.

As a result of the Department's experiments the camphor industry has been established on a firm basis. A large acreage is being planted to camphor in Florida, and interest in the growing of

this crop is increasing. From 3,000 to 4,000 acres of the trees are being prepared for planting in Florida alone.

BREEDING VARIETIES THAT CAN RESIST DISEASE

The question of securing rust-resistant varieties of asparagus has been given special attention during the year. The rust disease of asparagus is threatening this industry in a number of sections and the efforts being made are for the purpose of securing types which will be resistant or immune to the disease.

Work in the breeding of wilt-resistant melons was practically completed during the year. The new wilt-resistant hybrid melon was grown on a commercial scale during the past season and easily held its own in the market with the varieties of its class. It produced an excellent crop on land where ordinary melons were destroyed by wilt. In connection with the breeding of wilt-resistant cotton, further tests have been carried on with upland cottons. Some of these upland wilt-resistant types have not only proved valuable from the character of their lint, but also from the quantity of fiber produced. Considerable work has also been carried on in the matter of breeding alkali-resistant and drought-resistant plants. This work has included such crops as cereals, forage crops, grasses, and sugar beets.

NITROGEN BACTERIA AND SEED ADULTERATION

The distribution of bacteria for inoculating various legumes has been continued during the past year with increasing success. It has been found especially important to carefully examine soil conditions before inoculation, and a method of doing this quickly in the laboratory has been devised. Over 18,000 cultures have been distributed during the year, and, from the reports received to date, they have been used with success in the majority of cases.

The work against seed adulteration has been continued with gratifying results. Aside from the continued sale of Canada bluegrass seed for Kentucky bluegrass seed, fewer cases of adulteration have been found than in former years. The importation of low-grade red-clover seed has continued, some lots containing over 8,000,000 weed seeds per bushel.

THE TRUSTEE OF OUR FORESTS

At the beginning of the fiscal year the area of the national forests was less than 107,000,000 acres; at its close, more than 150,000,000 acres. Nearly all the timber land of the unappropriated public domain is now under actual administration by the Forest Service. This means that it is being protected against fire, theft, and wasteful exploitation, that its power to grow wood and store water is being safeguarded for all time, and that nevertheless its present supply of useful material is open to immediate use wherever it is wanted.

The government is not a landlord owner, but a trustee. Hence timber is given away through free-use permits only in small quantities to the actual home maker, who comes to develop the country, and in larger quantities to communities for public purposes. Otherwise it is sold to the highest bidder, but under such restrictions as look to the maintenance of a lasting supply answering to the needs of the locality, to be had without favoritism and without extortionate demand based upon the necessity of the consumer.

The forests are already self-supporting, though they have been under the control of expert foresters less than three years. The total expenditures of the Forest Service for all purposes during the year was $1,825,319.50—considerably less than I estimate that the receipts from the forests will be during the present year. As yet, however, from the standpoint of true economy the expenditure for the protection and improvement of these forests is far too low.

France spends annually upon state forests less than one-fiftieth the area of our own over $2,500,000 and realizes $4,230,000; Prussia spends upon 7,000,000 acres

over $11,000,000 and realizes $17,054,-144; Saxony spends upon only 400,000 acres over $900,000 and realizes $1,651,-882. Yet in all these countries, unlike our own, the forests have had great sums spent upon them in the past in the form of permanent improvements, to which are largely due their present returns. A forest can no more be made to yield a constant return in valuable products without the investment of capital in improving the property than can a farm.

IMMENSE POSSIBLE PROFITS FOR THE PEOPLE

If the United States spent as much per acre upon these forests as Prussia does upon hers, they would cost each year $250,000,000. If they brought in as much per acre, the gross revenue which they would yield would amount to $650,-000,000, and the net revenue to $400,000,-000. The development of the wealth-producing possibilities of the national forests—not, it must be insisted, in the narrow sense of income yield to the national treasury, but in that of economic usefulness to the people—is hardly begun.

I have asked for an appropriation for the Forest Service during the fiscal year 1909 of $3,200,000. This, if all spent upon the national forests, would amount to 2 cents per acre. France spends annually upon her state forest 95 cents per acre, Switzerland $1.32, Prussia $1.58, and Saxony $2.32. These are the countries in which the management of the forests is most profitable in products. The countries which spend most do so because their forests are brought to a high state of development. Thus utilizing their full productive powers, they derive from them a net profit which is very high. On the other hand, the countries like Sweden, Hungary, and India, which spend from 2 to 34 cents per acre, derive a very low revenue—in other words, a small volume of products—from their forests.

It is as sure that forest land can be made to grow successive crops of trees under proper methods as that plow land can be made to grow successive crops of wheat; as sure that forests can be made to conserve the water supply as it is that manuring enriches the soil.

The use of the national forests by the people of the West is increasing at an extraordinary rate. The value of timber sales, the number of stock grazed, the demand for free-use and special-use permits all tell the same story. The forests are more and more contributing to the material welfare of those in their vicinity.

IMPROVING THE RANGE

Unlike the demand for timber, the demand for range in the national forests is already large enough to employ practically the full productive capacity of the land. There were grazed last year on the forests over 1,200,000 horses and cattle and 6,650,000 sheep and goats, representing a total investment of perhaps $44,000,000 and a probable annual profit, under the conditions of recent years, of $8,000,000. Upon the cattle industry of the western range depends to a large extent the farmer of the prairie states for the profitable marketing of his corn crop, the workingman of the East for his food supply, and our foreign trade for one of its important articles of export. Under the conditions which obtained before the Forest Service undertook to regulate grazing, the carrying power of the range had seriously fallen off through overgrazing and competition. By putting a stop to these evils the Forest Service has not only partially restored the range to its former carrying power, but has also given greater stability to the stockman's industry by recognizing his right to protection against newcomers, and made it possible for him to bring his stock through in better weight and condition.

An exhaustive study of the possibility of range improvement through artificial seeding, through changes in the present methods of handling stock to favor the growth of the best native forage plants, and through extermination of poisonous plants has been inaugurated. The whole problem of range control and improve-

ment will be pursued until every part of the range in national forests is producing the best crops of forage which the circumstances will allow.

SOWING NEW FORESTS

The fires of past years and centuries have stripped great areas of western mountain timber land of all forest growth. The need of conserving the rainfall and snowfall of these areas makes reforesting a step of urgent necessity. At the same time it is often one of the utmost difficulty. In dry climates particularly (where the need is greatest), to establish a forest without prohibitive expense calls for the most careful study.

After plantations are apparently well established a season of unusual drought may turn the scale against the growing trees. Millions of acres must be planted—and this means that thousands of millions of small trees must be raised—but there is yet much to be done before planting on a scale commensurate with the needs can be begun. This preliminary work is being pushed with as much energy as the funds available for the work will permit.

In a large part of the Northwest, at least, there is good reason to believe that broadcast sowing of seed may be practicable. If this proves to be the case, the way will be open for restoring to forest cheaply very much of the burned-over land. Hitherto the experimental sowings have shown surprisingly good results. The country's need of timber is certain to be so acute before many years that the work can not be entered upon too quickly.

That the United States is even now nearing a time of severe scarcity of lumber is no longer a matter of doubt. Each year makes a further heavy inroad upon the remnant of our virgin forests, and the growth of our abused and depleted forest lands for three years would not meet our needs for one.

MAKING COMMON WOODS MORE DURABLE THAN OAK OR CHESTNUT

An easy and inexpensive method of treating fence posts has been perfected which makes it possible for any farmer to make the quickly decaying woods, still abundant because hitherto thought almost worthless, far more durable than untreated white oak or chestnut. Demonstrations of this method before southern farmers were received with enthusiasm. For the middle West, where the common woods are seldom resistant to decay, the matter is certainly no less important. Essentially the same method is being applied to the butts of telegraph poles and to mine props. The enormous consumption of timber for the latter purpose and the extreme rapidity with which it decays in the dampness and darkness of the mine open the prospect of a large economy from the use of this method of treatment, which has stood a searching practical test in Pennsylvania coal mines. By applying the same treatment to timbers from the national forests a use will be found for dead wood and a decided benefit will be conferred on the users of the timber. The work includes a study of the comparative merits of different kinds of preserving fluids.

The investigations aimed at discovering new sources of paper pulp have demonstrated that a number of woods of abundant supply, never in the past thought of for the manufacture of paper, are capable of yielding pulp of standard grade. Studies in wood distillation are establishing the practicability of obtaining turpentine from waste southern pine material.

Ten thousand separate tests of the strength of timber, largely in the form of full-sized structural beams, have established the relative value of a number of woods and proved the fitness for hitherto unthought of uses of several of them.

THE FOOD PRODUCED BY OUR FARMERS CAN BE INCREASED MANY TIMES

There are in the continental United States 1,900,947,200 acres of land. Of this, the tenth census showed 838,591,774 acres in farms, with 414,498,487 acres in improved lands and 289,734,591 acres actually in crops.

With a more thorough knowledge of the soil and its adaptation to crops and the proper methods of soil management, the full extent of the agricultural development which may take place in the United States in the future is very great. The undeveloped portions of the United States are not confined wholly to the arid West. When we realize that we have 77,000,000 acres of swamp land in the eastern half of the United States—an area equal to all of the New England States, New York, and half of Pennsylvania, or to the combined areas of Illinois and Iowa—which can be reclaimed, and which, under the prevailing climatic conditions when so reclaimed, are exceedingly productive, and when we realize that only 16 per cent of the State of Louisiana, for example, and a smaller percentage of the State of Texas is in improved lands, the possibilities of development become more apparent.

The soil survey work of the department is the largest undertaking of the kind that has ever been inaugurated in any country. The area surveyed and mapped during the past fiscal year was 20,560 square miles, or 13,158,400 acres, and there have been completed to June 30, 1907, surveys covering a total of 139,247 square miles, or 89,118,080 acres. This area is more than 15 per cent of the amount represented by the farm lands of the United States. The work has been so distributed as to include every large representative district in the United States.

One of the most important problems being studied by the department is the intelligent use of commercial fertilizers. In some sections of our country, especially in the South and East, the quantities now used are enormous, and this use is gradually extending. That the amount of money annually invested in fertilizers by the farmers of the country, now amounting to upward of $100,000,000, will continue to increase seems certain. But just as certainly a large percentage of the money—perhaps a third—is annually wasted and brings no adequate return, owing to a lack of understanding of the soil's requirements.

According to the latest determinations the rivers of the United States are annually pouring into the seas fully 1,000,000,000 tons of sediment. The volume of material thus lost to the land is increasing with settlement and cultivation; it is almost wholly washed from the surface and is the very richest soil material, the cream of the soil. The value of the material is not easily fixed, but at a moderate appraisal the annual loss would exceed all the land taxes of the country.

Part of this wastage may be avoided by deeper cultivation, drainage, terracing, etc., to which effective and simple methods the public is being educated by the department.

THE BOLL WEEVIL CHECKED

That the cotton-growers can be protected from the boll weevil by planting cotton early and by burning the plants in the fall, after the cotton has been harvested, has been proved by many experiments of the entomologists of the department. In one isolated locality in Calhoun and Jackson counties, Texas, badly infested with the weevil, 410 acres, comprising all of the cotton in that vicinity and separated from other cotton plantings by about 10 miles, were cut during the first ten days of October, 1906. In Lavaca county, 30 miles away, a considerable quantity of cotton was not destroyed, and the fields were kept under observation as a check. The results were as follows:

In May, 1907, in the experimental fields only one weevil was found, whereas in the check fields the weevils were so numerous that practically all of the squares had been destroyed. In September, 1907, the cotton in the experimental fields showed a yield of about 1,000 pounds of seed cotton per acre, while in the check fields the average was about 350 pounds of seed cotton per acre, and this in spite of the fact that the soil on the check area

is much richer than that in the experimental area. The destruction of the plants in October has caused the poorer land to produce practically three times as much cotton as the richer land. The proper treatment of the fields in the experimental area resulted in an advantage to the farmers of $20 per acre.

By burning the cotton plants after the harvest many millions of weevils in one stage or another are killed which otherwise would successfully pass the winter and infest the next year's crop.

IMPORTING BENEFICIAL INSECTS FROM EUROPE

The introduction of the parasites and predatory insect enemies of the gipsy moth and the brown-tail moth has been continued with great success, and it is reasonably certain that the gipsy moth can be held in check by these imported natural enemies just as it is in Europe.

In the early summer of 1907 the Chief of the Bureau of Entomology again visited parts of Europe, and by coöperation with European entomologists succeeded in introducing a much larger number than ever before of European parasites of the eggs and of the lavæ and pupæ of both the gipsy moth and the brown-tail moth. Two new species of primary parasites were introduced from Russia, and one of these proves to be a very rapid breeder and promises the best results.

These insects have been cared for in large indoor and outdoor breeding cages in the vicinity of Boston, and many thousands of specimens have been liberated in the open. There is abundant proof that several species have established themselves, and there is every reason to suppose that they will breed with greater or less rapidity. It is hoped that the results of the work of these parasites will be evident by the summer of 1909, and there is a possibility that they may be evident in 1908.

The life histories and habits of these parasites are being studied by expert assistants in the laboratory near Boston, and careful observations at the same time are being made by agents of the department in France and in Russia. Six generations of one species have been followed through during the past summer.

Altogether 35 species of these beneficial insects have been imported. Of these, 14 are hymenopterous parasites, 16 are dipterous parasites, and 5 are predatory beetles.

SENDING USEFUL INSECTS ABROAD

European officials have been so generous in their assistance to this country in these importations of beneficial insects that the department has endeavored to return the courtesy wherever possible. Continued sending of scale-insect parasites have been made during the year to Italy with promise of success.

An interesting coöperative experiment was begun during the year with the French government, and successful sendings of a predatory wasp from the Southern States to Algeria were made. On arrival in Algeria these wasps were cared for by agents of the Pasteur Institute of Paris, acting for the French colonial government, in the effort to establish a species which will destroy the gadfly, which carries a very destructive disease of the dromedary, so important in that country as a beast of burden.

HESSIAN FLY INVESTIGATIONS

The wheat-sowing experiments have been increased during the year, and are now being carried on in eleven states, over 800 different sowings having been under constant observation this year. Exact data are being continually accumulated, showing that it is possible to evade the most serious portion of the fall attack of the Hessian fly by seasonably late sowing in the fall.

An important branch of the Hessian-fly work has demonstrated the possibility of the practical use of the parasites of the fly. A striking example has developed during the year. Early sown plats at Lansing, Michigan, and Marion, Pennsylvania, were seriously attacked by the fly, but when examined at a later date

fully 90 per cent of the flaxseeds were found to have been stung by a certain species of parasite and to contain its developing larvæ. At this time a field of wheat near Sharpsburg, Maryland, was found to be infested by the fly and examination indicated the absence of parasites. On April 8 some thousands of the parasitized flaxseeds from Pennsylvania were brought to Maryland and placed in the field. On July 8 an examination of the Maryland field showed that the parasites had developed so rapidly as to bring about an almost total destruction of the fly.

ENCOURAGING SILK CULTURE IN THE UNITED STATES

Eighty-five ounces of tested silkworm eggs were imported from Italy and distributed to 343 applicants in the spring. About 11,000 seedlings of the best white mulberry were also distributed. Cocoons were purchased from American growers at a rate varying from 90 cents to $1.15 per dry pound, and these cocoons were reeled at the department. The reeled silk on hand was sold during the year at $4 a pound, bringing in a return of $1,012.

TRAFFIC IN CAGE BIRDS

The Biological Survey has continued the work of educating the public, and especially the school children, regarding the economic value of birds as insect destroyers, and the duty of protecting them.

The fact that 400,000 cage birds, most of them canaries, are yearly imported into this country, and that the number is constantly increasing, will surprise many. There seems to be no reason why most if not all the cage birds required in this country should not be raised here. The industry is very profitable in Germany and elsewhere abroad, where it is carried on by the women and children of individual families, who, with comparatively little labor and trouble, add an interesting occupation to their ordinary household duties and secure satisfactory returns in cash. The mountain regions of the Southern States, particularly, would seem to furnish almost ideal conditions for such an industry, which, besides being lucrative, possesses the added advantage of substituting domestic birds for such wild species as the mocking bird, cardinal, and nonpareil, whose value to agriculture is too great to make it desirable to confine them in cages.

DUCKS AND SHORE BIRDS

In the past, one of the important food sources of the United States was its game, particularly its ducks, geese, and shore birds, thousands of which found their way to the markets of all our large cities, to be used for food by rich and poor. Unfortunately the natural supply of these birds was not wisely husbanded with an eye to the future, but, as in the case of the buffalo and wild pigeon, they were mercilessly pursued, till at the present time not a few species are threatened with speedy extinction. The subject is important, and it is obvious that if the more desirable species of ducks and geese are to be preserved for the future, additional legislation is needed. The essential data to serve as a basis for legislative action are a knowledge of the food supply and of the pairing times of the several species of ducks, geese, and waders, and of the routes they pursue in migration. These subjects are now being carefully investigated.

Our game birds are constantly diminishing in abundance, and the practice of introducing foreign birds as a substitute grows in favor. Many species, serving both for food and sport, have already been more or less firmly established in various parts of the country. During the year Illinois imported more than 1,000 European partridges, and Kansas imported about 2,000 English pheasants. Capercailzie and black game of northern Europe, the former of which is nearly as large as wild turkey, have been imported successfully for liberation at various points, notably on Grand Island, Michigan, and in the Algonquin Park, Ontario.

The experiment of stocking covers by means of imported eggs of game birds also is apparently meeting with favor. Under the act of June 7, 1902, every such consignment requires a permit from the department. More than 5,900 eggs were imported during the year.

Life-zone maps of the several states are now in course of preparation, to be followed by lists of crops and fruits best adapted for cultivation in the different areas. The essential purpose of this work is to furnish the practical farmer a guide to the crops best fitted for any given area. The great demand for the generalized map and report already published and for the more detailed maps not yet finished is an earnest of the practical importance of this work.

THE BIGGEST PUBLISHING HOUSE IN THE WORLD

The results of the investigations conducted by the department are made known and become available for the use of the people by means of publications, of which 1,415 were issued during the year, 596 being new and 819 reprints. These publications comprised 52,363 printed pages and the total number of copies aggregated 16,746,910, being an increase of 3,258,889 copies over last year.

The farmers' bulletins continue to be the most popular publications of the department. Forty-two new bulletins were issued during the year, the number of copies printed being 1,100,000, while 443 reprints of bulletins were made in editions aggregating 5,369,000, the total number of Farmers' Bulletins printed in the year being 6,439,000 copies, of which 3,484,713 were distributed upon the order of Senators, Representatives, and Delegates in Congress. The total number of Farmers' Bulletins printed and distributed since the series was created in 1889 is 55,125,000, of which 37,400,161 have been distributed by members of Congress.

HELPING THE FILIPINO FISHERIES

ON October 14, the steamer *Albatross*, of the United States Bureau of Fisheries, sailed from San Francisco for the Philippine Islands, via Honolulu and Guam. By direction of the President, and at the solicitation of the insular government, the vessel has been detailed for a comprehensive investigation of the fisheries and an exploration of the waters of the archipelago.

Lieut. Commander Marbury Johnston, U. S. N., is in command, and the fishery and scientific inquiries will be under the personal direction of Dr Hugh M. Smith, Deputy Commissioner of Fisheries, who will be aided by a small corps of assistants from the Bureau. The National Museum has a representative on board in the person of Dr Paul Bartsch.

The chief objects of the expedition are a thorough study of the present condition of the fishing industry, a determination of the aquatic resources of the islands, and a demonstration to the natives of the best means of catching and utilizing the available resources. Other matters that will receive attention are fishery legislation, the cultivation of fresh-water and marine animals, and the foreign fishery trade. A great amount of dredging and sounding will be done in order to ascertain the location of the fishing grounds and the distribution and abundance of the bottom species; and it is expected that this work, taken in conjunction with the collections made in surface and intermediate waters, will have much scientific interest, aside from its practical bearing.

The *Albatross* has recently been put in a high state of efficiency, and is now equipped with the most modern paraphernalia for deep-sea and fishery research. Several years will be devoted to

the work, and it is believed that the investigations will constitute one of the most beneficent measures thus far taken by the United States government for the improvement of the industrial condition of the Filipinos.

THE ANGLO-AMERICAN POLAR EXPEDITION

THE following letter to Hon. O. H. Tittmann, Superintendent of the U. S. Coast and Geodetic Survey, describes some of the experiences of the Mikkelsen-Leffingwell expedition and the difficulties encountered by the explorer on the Arctic coast of Alaska:

FLAXMAN ISLAND, ALASKA,
VIA POINT BARROW,
August 16, 1907.

SIR: Our expedition to Banks Land has wound up here and I am endeavoring to make the most of the opportunity to add something to the meager knowledge of this region along geodetic and geologic lines. The program I hope to carry out consists of a map of the coast from Demarcation Point to the Coville River, the exploration of five rivers not now indicated on the map, four of them never visited by white men, and such geological work as I can do. The past year was devoted to expedition affairs and very little of the six months spent in the field was devoted to scientific work, so that to carry out the above program it will be necessary to remain another year. The expedition was supposed to be fitted for two years, and we have received some more provisions this summer, but we have used so much of our outfit in the purchase of dogs, furs, and fresh game that by the end of another year we shall be short on a good many things; consequently I am sending out for a third year's supply of provisions, coal, etc.

A part of the expedition returns this year, and next year I shall be alone and will be compelled to support a native family or two for hunters and to travel with me in the field; consequently I am in imperative need of the provisions. The only available way is to ship it in per whaler at a cost of from $25 to $50 per ton, and even then there is much uncertainty. This summer our stuff came in three different whaling ships. One landed her share; another had an injured propeller and was in a hurry to get to Herschell Island to have it repaired; the third had our freight buried under some tons of her own goods and refused to land it until she returned in September. A prospector 50 miles east of here, with whom I have been working in the mountains, had all his supplies carried by in a fog and will not get them until September.

In view of this uncertainty and of the excessive cost of freight, I wish to have my goods brought up by the revenue cutter *Thetis* on her annual trip north. She comes each year to Point Barrow, and this island is only 250 miles farther. I have already been at a personal expense of over $8,000 on this expedition, and, as I am doing work which would cost the government a large sum to duplicate, I feel that it is not asking too much to have supplies transported by the government. Personally I have made one trip (with mail) to Herschell Island, two trips to Baxter Sound surveying, one trip 80 miles into the mountains with pack on back, and spent two months on the ice to the north of here sounding and looking for supposed land. Other members of the expedition have been equally active, our ethnologist having been in the field nearly the whole winter working from the east mouth of the McKenzie River to the Corvette.

Of course, I am depending upon occultations for longitude, and brought along a two-inch telescope by Bausch and Lomb. I was at the ship only during two lunations, and on account of the almost continual gales succeeded in getting only one occultation of a 4.3 magnified star. I followed several smaller ones until nearly the calculated time, but always lost them before they were shut out. Try as I would, I could not keep the frost from my breath, hands, and even body from dimming and blurring the image.

I have an alt-azimuth by Gaertner, of Chicago, with a 12cm. circle (graduated by Berger), with which I can get a latitude observation with probable error of $\pm 1''.5$ with a set of eight pointings. The probable error of our observatory is about $\pm 0''.5$, mean of four sets. Last winter I had to use a siderial watch for time observations and found it very unsatisfactory; still the probable error of a time set on two stars, east and west, was generally about $0^{s}.5$. This last week I have changed our ship's chronometer to siderial time and I hope for better work this winter.

For work along the coast and sand reefs I have a small planetable with telescopic alidade furnished with an eye-piece micrometer mounted horizontally. By means of poles set up about 100m. apart I can carry a traverse which is to be corrected by latitude and longitude observations every 30 to 40 miles. The longitude I hope to carry toward Demarcation Point by latitude and a triangulation on the mountains to the west. The only way is to use chronometers in September, when the stars begin to show and navigation is still open.

Very respectfully,

E. DE K. LEFFINGWELL.

California Indians Pounding Acorn Meal for Food

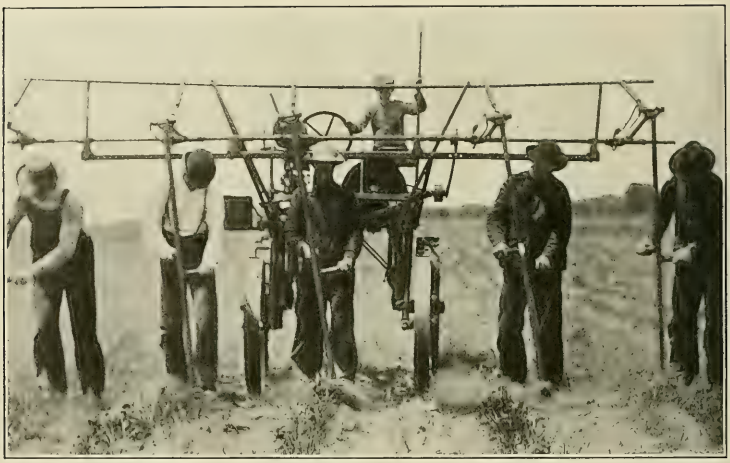
Photos from M. E. Jaffa, Dep't of Agriculture

California Indian Leaching Acorns for Food

Immense Piles of Sugar Beets Awaiting Shipment to the Factory

Polish Women Thinning Beets in the West

These women walk two to four miles in the morning to their work and back in the evening. They are well paid and become very skillful. Photos from C. O. Townsend, Dep't of Agriculture

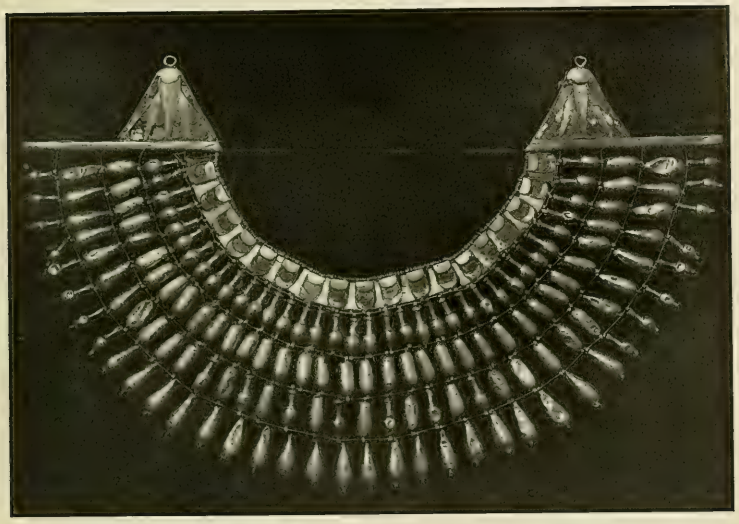


Power Hoe—Recently invented for use in the cotton fields, and which it is believed will prove equally successful in beet culture

NUTS AND THEIR USES AS FOOD

TO the last Year Book of the Department of Agriculture Prof. M. E. Jaffa, of the University of California, contributes an instructive article on the uses of nuts as food. The early explorers of America were much impressed by the extended use of nuts by the American Indians. The native hickories, butternuts, walnuts, chestnuts, and many other nuts found in the United States were gathered by the natives and formed one of their principal sources of food. The methods of preparing acorns for food, still followed by the Indians of northern California, are shown in the illustrations on page 797. The shelled nuts are split, dried, and ground with a mortar and pestle. The sifted flour is then placed in a hollow in the sand, on a convenient river bank, and leached to free it from the bitter principles present. From the leached meal a porridge or mush is made, which to the ordinary palate is much improved by the addition of salt. These typical Indian foods, when well prepared, are relished by many persons who have tried them, and it seems not improbable that improved methods of removing tannin and the bitter principles present in most varieties of acorns might result in the utilization of the acorn crop, which is fairly large and is generally wasted.

Lately the use of nuts has greatly increased in the United States, with the result that many persons are now growing native and foreign nuts on a commercial scale. The quantity of almonds, cocoanuts, Brazil nuts, filberts, peanuts, walnuts, and other nuts, shelled and unshelled annually imported into the United States is, in round numbers, 90,000,000 pounds with a value of $6,250,000. In 1905 the total almond crop in California reached 4,200,000 pounds and the walnut crop 12,800,000 pounds. The richest yield of peanuts was reported from the Southern States, chiefly Virginia, Georgia, and Tennessee, and amounted to 225,000,000 pounds.



Gold Necklace Found by Mr Davis in the Tomb of Queen Tiyi, January, 1907

AMERICAN DISCOVERIES IN EGYPT

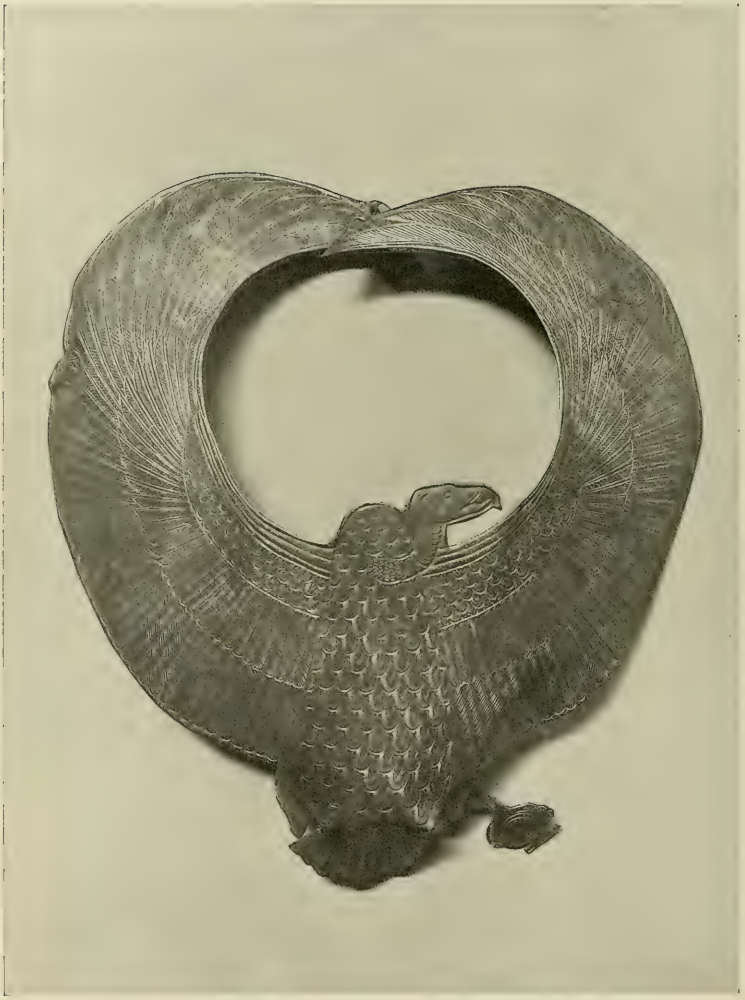
IN a recent address to the National Geographic Society, Mr Theodore M. Davis, of Newport, gave an interesting description of his discovery and opening of the tomb of Queen Tiyi in the Valley of the Tombs, Egypt, in January, 1907. Queen Tiyi was one of the most romantic personages in Ancient Egypt, and, though not of noble birth, because of her beauty became the Queen of Amenhotep II. She ruled at a time when Egypt was at the height of its fame and wealth, and both she and her husband vastly increased the power of the kingdom. Queen Tiyi, however, was not sympathetic with the ancient religion, and through her influence her son, Akhnaton, who ruled for nearly thirty years, abandoned the Egyptian gods and endeavored to establish a belief in one God. According to Mr Davis, Akhnaton was the first ruler in authentic history who argued that there was only one God. His influence was, however, unfortunate from a material point of view, as he lived in seclusion and devoted himself almost entirely to meditation, with the result that the empire dwindled away during his reign.

The mummy of Queen Tiyi was found in a golden coffin made in human form and richly studded with jewels and precious stones. A vulture diadem of gold was placed around her head and the body wrapped in sheets of gold. The tomb contained four canopic vases containing the queen's heart and intestines, beautiful alabaster vases and dishes, and exquisite inlaid furniture.

Mr Davis is a man of means, who at his own expense has been carrying on explorations in Egypt for nearly 20 years. Two years prior to this last discovery he found the tombs of Queen Tivi's father and mother, Uaa and Tuaa. His work is done solely for the benefit of science and the joy of discovery, as all his discoveries become the property of the Museum at Cairo.

Canopic Heads of Queen Tiyi and other Objects, Found in Her Tomb by Mr Davis in January, 1907

Head of Queen Tiyi Found in Her Tomb by Mr Davis



The Golden Vulture Found on the Head of Queen Tiyi

Mummefied Monkeys and Dog Found by Mr Davis in the Tomb of Amenhotep II

This king was very fond of monkeys, and when he died his pets were placed near him

Mummefied Monkeys Found by Mr Davis in the Tomb of Amenhotep II

Other curious contents of the tombs were mummefied ducks and chickens. These were preserved in wooden vessels, carved to represent the bird they contained. Another vessel contained delicious honey, which had been there for thousands of years

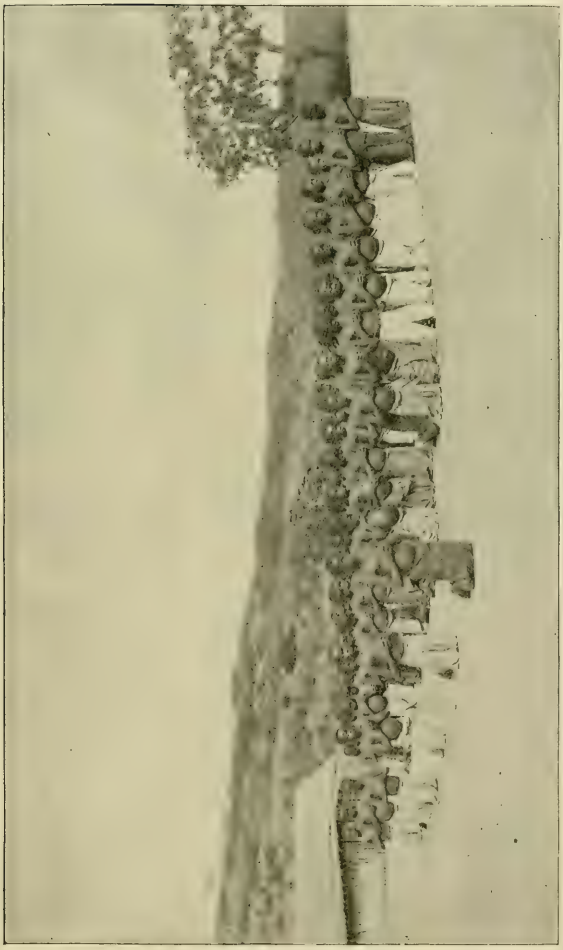
Cicatrised Batetela Woman (Lualaba-Kassai)

Specimens of Hairdressing Among Women of the Sango Banzyville (Ubanghi)

From "The Story of the Congo Free State." Copyright by Henry Wellington Wack

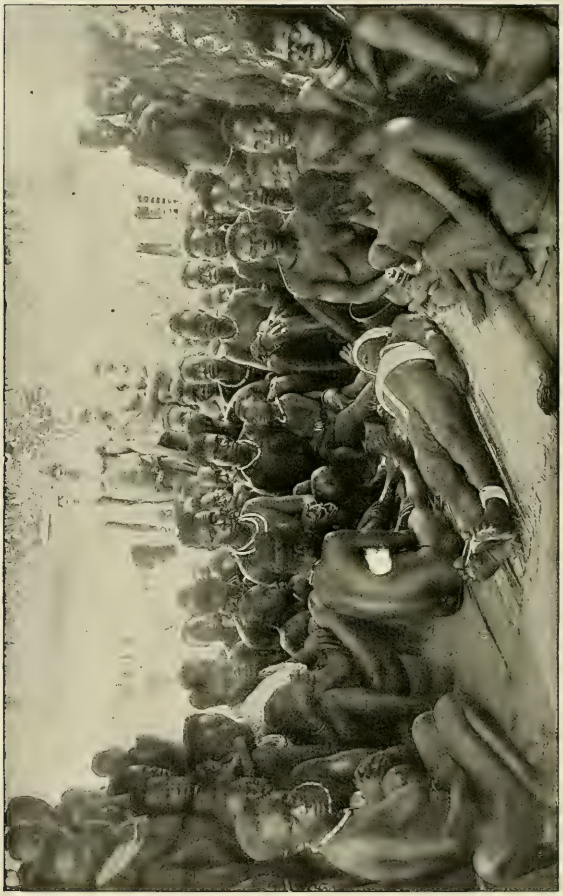
Native Huts Built of Leaves (Aruwimi)

From "The Story of the Congo Free State." Copyright by Henry Wellington Wack



Children of the Settlement School at Boma Praying

From "The Story of the Congo Free State." Copyright by Henry Wellington Wack



Funeral at Bumba (Bangala)

From "The Story of the Congo Free State." Copyright by Henry Wellington Wack

English Missionaries and Some of their Charges

From "The Congo and Coasts of Africa." Copyright by Richard Harding Davis

THE TRUTH ABOUT THE CONGO*

WE have been hearing so much in the last several years of cruelties and slavery in the Congo Free State that three volumes just published on this part of the world will prove very welcome. The authors do not agree in their conclusions. Mr Wack had free access to all the archives of the Belgian government, with permission to read private and secret reports from governors in the Congo Free State. Dr Frederick Starr lived for nearly a year in the Congo Free State, traveling 15,000 miles on its rivers. Mr Richard Harding Davis spent several weeks in the Congo regions and the neighboring colonies of French Cameroon.

Mr Davis declares that the worst stories told of Belgian cruelties and murder fall far short of the actual atrocities taking place, while both Mr Wack and Dr Starr emphatically deny these outrages, and it must be admitted that they present a much stronger case. They admit that there are occasional instances of misgovernment in the Congo, as in every part of the world, but they assert that as a whole the government is considerate, wise, and effective.

To quote from Dr Starr:

"Of course, I saw much to criticise. It is true that there are floggings, and chain-gangs, and prisons. I have seen them all repeatedly. But there are floggings, chain-gangs, and prisons in the United States. Mutilations are so rare that one must seek for them; and I had too much else to do.

* The Story of the Congo Free State. By Henry Wellington Wack. With 125 illustrations and maps. Pp. 634. G. P. Putnam's Sons.

The Truth about the Congo. By Dr Frederick Starr. With illustrations. Pp. 129. Forbes & Co. (Chicago).

Congo and the Coasts of Africa. By Richard Harding Davis. With illustrations. Pp. 220. Charles Scribner's Sons.

The Salt Plain of Lop

From "The Pulse of Asia." Copyright by Ellsworth Huntington

"Of frightful outrages, such as I had expected to meet everywhere, I may say there was nothing.

"On the contrary, I found at many places a condition of the negro population far happier than I had dreamed it possible. The negro of the Congo—or Bantu, if you please—is a born trader. He is imitative to a degree. He is acquisitive and charmed with novelties. He is bright and quick, remarkably intelligent. He readily acquires new languages, and it is no uncommon thing to find a Congo Bantu who can speak six or seven languages besides his own. In disposition variable and emotional, he quickly forgets his sorrow. I saw hundreds of natives who were working happily, living in good houses, dressing in good clothes, of European stuff and pattern, and saving property. That this number will rapidly increase I have no doubt."

Mr Wack is equally positive:

"The growth of the Congo Free State has from the first been skillfully directed by clever men of thought and action. Now that the transformation is complete, and what but three short decades ago was the very heart of savagery has become a valuable commercial and political asset, the forcible ejectment from the African Continent of the authors of all this good is openly discussed! Such is the reward which it is proposed should be meted out to the gallant, self-sacrificing little nation which has replaced the horrors of barbarism by the blessings of civilization, and incidentally discovered vast material wealth."

Mr Wack also describes the political, social, and economic aspects of the Belgian system of government and the almost boundless natural wealth of the Congo Free State: "The forests of the Congo are the finest in the world. They contain a great variety of hard and soft wood, fruit-bearing trees, rubber trees and vines and gum trees and constitute an industrial wealth which is being preserved by enforcing rigorous laws." The Free State is one-third the size of the United States. It lies squarely across the heart of Africa with an outlet to the sea on the west coast, which brings it comparatively near the European markets. It separates the British African Empire—the Soudan and the Nile country on the north from the Cape and Rhodesia territory—in a manner most aggravating to the British. As Mr Wack puts it, the British statesman who is ambitious to develop his country's influence in Africa, feels as an American would who saw the Louisiana Purchase territory owned by a small foreign power.

GEOGRAPHICAL BOOKS OF 1907

The South Americans. The story of the South American Republics, their characteristics, progress, and tendencies: with special reference to their commercial relations with the United States. By Albert Hale, A. B., M. D. Pp. 361. 9 x 5⅞ inches. Illustrated. Indianapolis: The Bobbs-Merrill Co. 1907.

Dr Hale lived many years in South America, visiting every country he describes. He makes many startling statements of the wonderful possibilities of the continent. For instance, speaking of the 800,000 square miles of Argentina embraced in the basin of the Parana, he says:

"Nearly every acre of this land in Argentina is, with the simplest of railway construction, within reach of the Atlantic Ocean. There are no natural barriers to overcome, such as we have in the Alleghanies on the east, or in the Rockies on the west. Produce that cannot be floated down a river to tide-water could be loaded on to cars and with slight expense and a short haul be mechanically transferred to modern ships in modern harbors, with the whole consuming world of Europe closer to their producing areas than are the fields of our Middle West. How immense are these storehouses of nature and how close to markets can scarcely be grasped except by a close study of their geography."

The Continent of Opportunity. The South American Republics—their history, their resources, their outlook. Together with a traveller's impressions of present-day con-

Bedouin Woman and Child

From "Nigeria, Our Latest Protectorate," by C. H. Robinson

ditions. By Francis E. Clark. Pp. 349. 5½ x 8⅜ inches. Illustrated. New York: Fleming H. Revell Co. 1907.

Perhaps the best chapter in Dr Clark's admirable account of his five months' journey around South America is that on "Brazil—the Boundless."

"Brazil owes its predominant importance among the South American States to the productiveness of its soil and the variety of its resources quite as much as to its vast size. It is not too much to say that every product that makes for the comfort and wealth of mankind is found in Brazil. Coffee, sugar, cotton, rubber, corn, wheat, diamonds, gold, are only a few of her products, and the undeveloped and even unexplored wealth of the country is infinitely greater than that which can be catalogued.

"The country rises abruptly, but not inaccessibly from the shore for hundreds of miles, and the table-lands that lie back from the coast at a height of two or three thousand feet enjoy all the blessings of a temperate climate, even when they lie within the tropics. Moreover, the rainfall throughout almost the entire length and breadth of Brazil is sufficient to produce the most luxuriant vegetation in the world, a luxuriance which led Amerigo Vespucci, the navigator who gave his name to both continents, to say that 'if Paradise did exist on this planet, it could not be far from the Brazilian coast,' while Agassiz believed that 'the future center of the civilization of the world would be in the Amazon Valley.'

"The contrast in respect to verdure and vegetation between the east and west coasts of South America is as the difference between the garden of Eden and the desert of Sahara. On the west coast for twenty-five hundred miles one scarcely sees a tree or a blade of grass—only sand-swept mountains, grand and impressive, to be sure, but forbidding in the extreme. Throughout the vast coast line of Brazil one can hardly conceive how another blade of grass could grow or another tree could stand in the crowded, luxuriant vegetation that now occupies the soil."

The Andes and The Amazon. Life and travel in Peru. By C. Reginald Enock. Pp. 370. 9¼ x 6 inches. Illustrated. Map. New York: Imported by Charles Scribner's Sons. 1907. $5.00 net.

An eloquent and sympathetic account of ancient and modern Peru:

"Peru is a country covered with a certain halo of romance—the romance of history; of that time when continents were found, taken, and explored; the romance of a civilized and little known race—the Inca—extending back before the keels of those old caravels from Europe ploughed the seas of the New World; the romance of the Spaniards, picturesque and cruel; the romance of Nature in her most stupendous operations, her Andean and Amazonian handiwork.

"Peru contains all the products of the tropical, semi-tropical, and temperate zones and her 1,400 miles of Pacific littoral, and situation upon the largest system of navigable waterways in the world—the Amazon and its affluents—must some day cause her to become the center of a busy and extensive population.

"Peru is a country of large things; it has one of the greatest mountain ranges in the world—the Andes; it has the longest river system—the Amazon and its affluents—and the

most extensive forests; it has some of the highest peaks on the globe, and many of its mineral deposits are, of their kind, the largest in the world. From all this greatness of nature shall not there spring some day greatness of man—a leader of nations of her race and in her hemisphere?

Chile: Its history and development, natural features, products, commerce, and present conditions. By G. F. Scott Elliot. With an introduction by Martin Hume. Pp. 341. 9 x 5⅞ inches. Illustrated. Bibliography, appendix, and map. New York: Charles Scribner's Sons. 1907.

This is the best book on Chile published in some years. The peculiar geographical formation of the country "extending, as it does, in a narrow strip hemmed in by mountains, and embracing every variety of climate from the rainless Atacama to the rainy Magallanes, marks it out as the future dominant sea-power of South America. Its fine bays and harbors, its abundant coal supplies, and, not least, the ideal conditions of the south for producing a hardy, sea-faring race, ensure the perpetuation of the tradition that Chile is to be the mistress of the southern seas in the ages yet to come. But its vast, fertile plains, where every product of the temperate clime grows luxuriantly, its immense herds of cattle, its abounding mineral wealth, as yet hardly touched, the vast, stretching, virgin forests upon its mountain slopes, its inexhaustible fisheries, and, above all, its laborious, hardy population, destine it to attain national greatness and wealth on land as well as on sea. All that Chile needs is time and peace to become one of the great nations of the world."

Mexico and Her People of Today. An account of the customs, characteristics, amusements, history, and advancement of the Mexicans and the development and resources of their country. By Nevin O. Winter. Pp. 405. 8¼ x 5¾ inches. Illustrated. Boston: L. C. Page & Co. 1907.

This book is a concise and entertaining description of the country as it appears to the visitor. Mr Winter says:

"The accomplishments of the past twenty years in Mexico are marvelous. Americans who have lived there during that time wax eloquent in describing the great change for the better. Whereas formerly people hesitated to invest money for fear of political changes, now investments are as safe there as in any other country, and the Mexican securities have a fixed value on the bourses of the world.

"Modern luxuries and conveniences are being introduced everywhere. The people are simply installing in a hurry the things that other countries have been acquiring for half of a century. Every city is bestirring herself, and electric light plants, modern sewerage systems, and water works are being constructed.

"The development of the water power of the Republic is now commanding considerable attention. The greatest undertaking attempted as yet is that which is now nearly finished, in which the Necaxa falls are utilized. The transmission lines reach a length of 171 miles. When completed this plant will have a capacity of 200,000 horse-power, and will supply the City of Mexico, Puebla, and other cities with cheap and unlimited power. Other waterfalls are awaiting development, and it may be that the energy of nature will supply the great need of Mexico for a cheap and satisfactory power to develop her other resources."

Recollections of An Ill-fated Expedition to the Headwaters of the Madeira River, in Brazil. By Neville B. Craig. Pp. 474. 9 x 5⅞ inches. Illustrated. Maps. Philadelphia: J. B. Lippincott Co. 1907.

Guide to Modern Peru. Its great advantages and vast opportunities. By A. de Clairmont, M. D., Consul of Peru. Pp. 66. 5½ x 7¾ inches. Illustrated. Toledo, Ohio. 1907.

An interesting publication distributed by Dr Clairmont free of charge.

How to Prepare for Europe. A handbook of historical, literary, and artistic data, with full directions for preliminary studies and traveling arrangements. By H. A. Guerber. Pp. 527. 6¾ x 4¾ inches. Illustrated. Maps. New York: Dodd, Mead & Co. 1907.

This volume is heartily recommended as an advance guide to all who contemplate a trip to Europe. It contains many maps and a list of good books on each country. The general reader who desires the best mental and material preparation for such a journey will find this handbook indispensable.

The European Tour. By Grant Allen. Pp. 297. 7¼ x 4¾ inches. New York: Dodd, Mead & Co. 1906.

The Highlands and Islands of Scotland. Painted by W. Smith, Jr. Described by A. R. Hope Moncrieff. Pp. 232. 9 x 6⅜ inches. Illustrated. Map. London: A. & C. Black. American agent: The Macmillan Co. 1906. $3.50 *net.*

England and the English. An interpretation. By Ford Madox Hueffer. Pp. 354. 8⅛ x 5¾ inches. Illustrated. New York: McClure, Phillips & Co. 1907.

The Red Reign. The true story of an adventurous year in Russia. By Kellogg Durland. Pp. 533. 8½ x 5¾ inches. Illustrated. New York: The Century Co. 1907. $2.00 *net.*

During the five months ending March 5, 1907, according to an official statement, says Mr Durland, 764 persons were executed in Russia for political crimes and activities, or an average of 5 a day. When the reader realizes that the executions by guillotine in France during the Terror were only 2,300, the appropriateness of the author's title, "The Red Reign," is evident. The revolution will probably last for many years, but the ultimate triumph of the people is inevitable. Mr Durland's narrative is dramatic in the extreme, and probably is as fair and accurate a picture of present political conditions in Russia as has been written.

"Since October, 1905, the Russian people have advanced enormously, and the Duma experiments, handicapped as they were, have yet proved immense educational influences; they have served to arouse the whole people to what may be, and to awaken within them a realization of what sooner or later must be. On this count alone the value of these short-lived parliaments must not be underrated. The Russian people now understand their own situation as they never have grasped it before. They have not merely lost faith in the Czar; they have learned that the trouble with Russia today is that it suffers a blight, and that blight is autocracy, which in its very essence is incompatible with modern civilization, and that while the obliteration of autocracy may be a long task, the only escape from their present bondage is the accomplishment of this task; and the period of the struggle making for this end will be recorded in history as the Russian Revolution."

Poland: the Knight Among Nations. By Louis E. Van Norman. With an introduction by Helena Modjeska. Pp. 359. 8½ x 5¾ inches. Illustrated. New York: Fleming H. Revell Co. 1907. $1.50 *net.*

In view of the hundreds of thousands of Poles who have been coming to the United States in recent years, this excellent description of that remarkable race will prove of value to all students of our immigration and citizenship problems.

"If the Polish eagle has never yet been tamed; if it bears its captivity and its wounds, but refuses to become domesticated, it is because the Polish women have nursed it and kept before it the scent of the upper air and the love of liberty. If no prescription has as yet been discovered for making a Russian or a German out of a Pole, it is because the Polish women have kept the fountain head of the national life pure and incorruptible. Frederick the Great once said, "In Poland the women attend to politics, while the men get drunk."

"As among all original Slav races, the Polish woman of the lower classes has not yet emerged from the physical and mental slavery of former ages. Among the Polish peasants, as among the Russians, she is valued chiefly for the work she can do and for the number of children she can bear. What little freedom and happiness she has ceases after marriage, and a peasant woman, old, stooped, and haggard at twenty, with a heavy, stupid child in her arms, wearily tramping the muddy road of some village, or driving the cows afield in the pelting rain, is a sight to personify "dull care," a typical "woman with the hoe."

"The Poles grow up and become good Americans. The Polish immigrants spread over our great West, and the cities of Buffalo, Chicago, Milwaukee, Pittsburg, Cleveland, Philadelphia, Detroit, and Toledo are the main centers in which they congregate. In Chicago alone there are more than 250,000 of them, forming the largest Polish city in the world after Warsaw and Lodz. They come from all sections of the former commonwealth, but principally from Galicia. They are, in general, industrious, frugal, and soon amass a competency. Comparatively few professional men or members of the upper social classes have come to this country except for political reasons. The following is the Polish population in the United States (I quote even thousands), a total of somewhat over 2,000,000:

Pennsylvania	423,000
Illinois	389,000
New York	356,000
Wisconsin	198,000
Michigan	161,000
Massachusetts	129,000
Ohio	96,000
New Jersey	93,000
Minnesota	89,000
Connecticut	61,000
Indiana	41,000
Missouri	21,000
Maryland	19,000
Nebraska	19,000
Texas	18,000"

The Whirlpool of Europe. Austria-Hungary and the Habsburgs. By Archibald R. Colquhoun and Ethel Colquhoun. Pp. 349. 8¾ x 6 inches. Illustrated. Maps and diagrams. New York: Dodd, Mead & Co. 1907.

Nowhere else in Europe is the past so intermingled with the present, and under the Emperor-King Francis Joseph one may study at the same time every phase of European civilization, and every kind of question—racial, political, and social—which has agitated Europe in the last two centuries.

The Alfold, the richest agricultural land of Hungary, is the great central plain, the largest in Europe, and the dwellers in this region are passionately attached to their wide spaces and distant horizons, which they prefer to the most majestic mountain scenery. Even the extreme cold of the winter, when the sea of gold is

A Typical Hansa Village in Nigeria
From Nigeria "Our Latest Protectorate," by C. H. Robinson

turned into a frozen lake, does not shake their allegiance; and indeed this fertile alluvian plain is a true mother to the Magyar race, and in its situation and conditions lies the key to much that is wonderful in the history of the nation it shelters. A fertile soil, genial climate, and a splendid system of waterways make it one of the picked spots of Europe, and the development of the Magyar race took place under fortunate circumstances. It is well that they repay their motherland with the affection that is her due, for she has been the source of their prosperity and unity.

The size of the estates of the Hungarian aristocracy, churches, and municipalities is phenomenal. Altogether they occupy not less than 40 per cent of the land, while several estates count more than 57,000 hectares (140,790 acres) and one or two as much as 228,000 hectares (563,160 acres). The nobles of the second rank own only 14 per cent of the land, while there is a peasant proprietor class, numbering about two millions, which owns 46 per cent of the land.

The Magyar peasant woman does not, as a rule, work in the fields. Her business is to keep the home, for the Magyar prizes comfort and insists on a certain standard of it. As a consequence the peasant houses in most agricultural districts are clean and tidy, and on the Alfold they are generally perfect models of order and cleanliness. Every self-respecting Magyar housewife wants to have a room in her tiny house on which she lavishes her skill in needlework. The great criterion of respectability is the number of embroidered pillows in this spare room, and some cottages boast as many as eight or nine of these coveted possessions.

The numerous illustrations and maps are admirable, and altogether "The Whirlpool of Europe" makes one of the most useful publications of 1907.

Through Savage Europe. Being the narrative of a journey undertaken as special correspondent of the Westminster *Gazette*, throughout the Balkan States and European Russia. By Harry de Windt. Pp. 300. 9 x 5⅞ inches. Illustrated. Philadelphia: J. B. Lippincott Co. 1907.

The Balkan Trail. By Frederick Moore. Pp. 296. 8½ x 5½ inches. Illustrated. Map. New York: Macmillan Co. 1907.

The France of Today. By Barrett Wendell. Pp. 379. 8¼ x 5½ inches. New York: Charles Scribner's Sons. 1907. $1.50 *net.*

Peasants of "Little Russia"

From "Savage Europe." Copyr ight by J. B. Lippincott Co. 1907

Holland Sketches. By Edward Penfield. Pp. 147. 9¾ x 7¼ inches. Illustrated. New York: Charles Scribner's Sons. 1907.

The thirty beautifully-colored pictures contained in this volume illustrate the picturesque in Holland.

Italy, the Magic Land. By Lillian Whiting. Pp. 457. 8¾ x 6 inches. Illustrated. Boston: Little, Brown & Co. 1907.

The Riviera. Painted and described by William Scott. Pp. 232. 9 x 6½ inches. With 75 colored illustrations. New York: The Macmillan Co. 1907. $6.00.

Russia and Reform. By Bernard Pares, M. A. Pp. 576. 9 x 5¾ inches. New York: E. P. Dutton & Co. 1907.

Greece and the Ægean Islands. By Philip Sanford Marden. Pp. 385. 8½ x 5¾ inches. Illustrated. New York: Houghton, Mifflin & Co. 1907. $3.00.

Greece. Painted by John Fulleylove. Described by the Rev. J. A. McClymont. Pp. 227. 9 x 6½ inches. Illustrated. New York: Macmillan Co. 1907.

Constantinople. Painted by Warwick Goble. Described by Alexander van Millingen. Pp. 282. 9 x 6½ inches. Illustrated. Map. New York. Macmillan Co. 1907.

The illustrations have been badly chosen, giving only a faint impression of one of the most fascinating cities of the world. The text, however, is interesting and authentic.

Algiers and Beyond. By M. W. Hilton-Simpson. Pp. 295. 5¾ x 8¾ inches. Illustrated. New York: D. Appleton Co. 1907.

Big Game Shooting on the Equator. By Captain F. A. Dickenson. With an introduction by Sir Charles Norton Eliot. Pp. 285. 9⅛ x 6 inches. Illustrated. New York: John Lane Co. $4.00.

In Wildest Africa. By C. G. Schillings. Translated by Frederic Whyte. Pp. 711. 9½ x 6½ inches. Illustrated. New York: Harper & Brothers. 1907.

Admirers of "Flashlights from the Jungle," undoubtedly the most remarkable book of wild life ever published (see NAT. GEOG. MAG., August, 1907), will be disappointed in this second volume by Mr Schillings, which evidently consists of pictures discarded by the first publication.

Across Widest Africa. An account of the country and people of Eastern, Central, and Western Africa as seen during a twelve months' journey from Djibuti to Cape Verde. By A. Henry Savage Landor. 2 vols. Pp. 396 + 500. With 160 illustrations and map. 7 x 10 inches. New York: Imported by Charles Scribner's Sons. 1907.

Le Plateau Central Nigerien. Une mission Archéologique et ethnographique au Soudan français. By Lieut. Louis Desplagnes. Pp. 500. 6½ x 10 inches. With 236 illustrations and map. Paris: Emile Larose. 1907.

Queer Things About Persia. By Eustache de Lorey and Douglas Sladen. Pp. 381. 9¼ x 6½ inches. Illustrated. Philadelphia: J. B. Lippincott. 1907. $3.50.

The Unveiled East. By F. A. McKenzie. Pp. 347. 8¾ x 6 inches. Illustrated. Maps. New York: E. P. Dutton & Co. 1907. $3.50.

China and America Today. A study of conditions and relations. By Arthur Smith. Pp. 239. 7¾ x 5¼ inches. New York: Fleming H. Revell & Co. 1907.

A Handbook of the Philippines. By Hamilton M. Wright. Pp. 429. Illustrated. Maps. Chicago: A. C. McClurg & Co. 1907. $1.40.

Everyday Life Among the Headhunters. And other experiences from east to west. By Dorothy Cator. Pp. 212. 7¾ x 5¼ inches. Illustrated. New York: Longmans, Green & Co. 1905.

Lotus Land. Being an account of the country and the people of Southern Siam. By P. A. Thompson. Pp. 312. 9 x 6 inches. Illustrated. Map.

The Voyage of the "Discovery." By Captain Robert F. Scott. Vol. 1, pp. 210. Vol. 2, pp. 387. 8¼ x 5½ inches. Illustrated. New York: Charles Scribner's Sons. 1907. 2 vols. $3.00.

This is an inexpensive edition of Captain Scott's remarkable book, reviewed at length in this magazine in February, 1907.

Fiji and Its Possibilities. By Beatrice Grimshaw. Pp. 315. 9⅝ x 6½ inches. Illustrated. New York: Doubleday, Page & Co. 1907. $3.00 *net.*

The Use of the National Forests. By Gifford Pinchot, U. S. Department of Agriculture. Pp. 42. 7⅛ x 5 inches. Illustrated. 1907.

The object of this little book is to explain what our forest reserves mean, what they are for, and how to use them.

How the World is Fed. By Frank G. Carpenter. Pp. 362. 7½ x 5¼ inches. Illustrated. New York: American Book Co. 1907.

The author takes the reader on personally conducted tours to the great food centers of the world, to the markets of exchange, to the factories, the farms, the forests, and the seas. Interesting for old and young.

Statistical Abstract of the World. By Henry Gannett. Pp. 84. 6⅛ x 4 inches. New York: John Wiley & Sons. 1907. $0.75.

The book consists of tables showing area and population for all or most of the civilized countries of the earth, the population being classified by race, language, sex, birthplace, literacy, school attendance, conjugal condition, and religion; population of large cities; rates of increase of population; vital statistics; illegitimate births; defectives; breadwinners; financial statistics, and railway mileage and shipping; the mineral productions, including all metals and minerals of importance; agricultural products and consumption; livestock and fisheries; manufacturing products and consumption; wooded and cultivated areas; foreign commerce by countries and by commodities.

Camping and Tramping with Roosevelt. By John Burroughs. Pp. 111. 7⅝ x 5 inches. Illustrated. New York: Houghton, Mifflin & Co. 1907.

Handbook of American Indians. North of Mexico. Edited by Frederick Webb Hodge. Pp. 972. 9½ x 6 inches. Illustrated. Map. Washington: Government Printing Office. 1907. In two parts. Part 1.

A cyclopedia of the North American Indian. Descriptions of every tribe, of their myths, dances, and customs are given, as well as biographies of noted Indian characters.

Albanian and Bulgarian Captives in Macedonia
From "The Balkan Trail." Macmillan Co.

The Indian's Book. An offering by the American Indians of Indian Lore, Musical and Narrative, to form a record of the songs and legends of their race. Recorded and edited by Natalie Curtis. Pp. 573. 10⅛ x 7¼ inches. Illustrated. New York: Harper & Bros. 1907.

The American Indian. As a product of environment, with special reference to the Pueblos. By A. J. Flynn, Ph. D. Pp. 275. 5¼ x 8 inches. Illustrated. Boston: Little, Brown & Co. 1907.

Handbook of the Trees. Northern States and Canada. By Romeyn Beck Hough, B. A. Pp. 470. 9¾ x 7¼ inches. Illustrated. Published by the author. Lowville, N. Y. 1907. $8.00.

Mr Hough gives photographic illustrations of the fresh leaves, fruits, leafless branchlets and typical bark of every American tree east of the Rocky Mountains, with a map showing its geographic distribution. With this book as a guide any person can identify any tree east of the Rockies in winter, spring, summer or autumn. Years were required to obtain this photo-descriptive record, owing to the many difficulties met.

"Chief among these were the 'off' years, during which a species does not bear fruit. For example: One season I could not find a single tree of the common sugar maple bearing fruit, though I examined many from northern New York to North Carolina and westward to Missouri. One winter not a solitary twig could I find of the Yellow Birch bearing its dormant catkins, and, naturally, not a tree bearing flowers or fruit the next summer. I searched in vain two successive seasons for the pistillate flowers of the common butternut, so regularly did the late frosts of spring destroy them, though the staminate flowers appeared annually.

"The shortness of the period, too, during which the flowers or fruits of certain trees are in their prime, or even exist on the trees, has necessitated close watch. The exact time must be ascertained by observation, and if, perchance, I miss it I must wait until another year for another opportunity. Then I may find it an

Dogs Occupy the Pavement, People Walk in the Streets

Scene in Constantinople. From "The Balkan Trail." Macmillan Co.

off year (imagine my disappointment!), and still another year must be waited. Procuring specimens from lofty tree-tops are trivial ordeals compared with instances like these. Add to these vicissitudes the distribution of our trees, and the consequent necessity of being in many places at about the same time, and it can be readily understood that the field work required many seasons."

Afield With the Seasons. By James Buckham. Pp. 174. 7⅝ x 5⅛ inches. Illustrated. New York: Thomas Y. Crowell & Co. 1907. $1.25.

The Mountain People of Kentucky. An account of present conditions with the attitude of the people towards improvement. By William H. Haney. Pp. 196. 8¼ x 5½ inches. Illustrated. Cincinnati, Ohio: The Robert H. Clarke Co. 1906.

Mr Haney refutes the prevalent idea that these mountaineers are ignorant and sodden, maintaining that with opportunity they become eager to improve their condition.

The Future in America. A search after realities. By H. G. Wells. Pp. 259. 8⅛ x 5½ inches. Illustrated. New York: Harper & Bros. 1906.

The Wonder Book of Volcanoes and Earthquakes. By Prof. Edwin J. Houston. Pp. 369. 7½ x 5¼ inches. Illustrated. New York: Frederick A. Stokes & Co. 1907.

American Birds. Studied and photographed from life. By William Lovell Finley. Pp. 256. 8¼ x 5¾ inches. Illustrated. New York: Charles Scribner's Sons. 1907.

Representative birds from the humming bird to the eagle are described. Mr Finley carried both camera and notebook, and has succeeded in his purpose, to portray the bird as a live creature, showing its real wild personality and character.

Mars and Its Canals. By Percival Lowell. Pp. 393. 9 x 6 inches. Illustrated. New York: Macmillan Co. 1907. $2.50.

Earthquakes. An introduction to Seismic Geology. By William H. Hobbs. Pp. 336. 7⅞ x 5¼ inches. Illustrated. New York: D. Appleton & Co. 1907.

The Soil. Its nature, relations, and fundamental principles of management. By F. H. King. Pp. 303. 7¾ x 5¼ inches. Illustrated. New York: Macmillan Co. 1907.

The amateur and professional farmer will find this volume of much assistance.

The Turkish Barbershop
From "The Balkan Trail." Macmillan Co.

Modern Lithology. Illustrated and defined. For the use of university, technical and civil-service students. By Ernest Howard Adye. Pp. 128. 7½ x 5 inches. Illustrated. Edinburgh and London: W. & A. K. Johnston. 1907.

The Negro Races. A sociological study. Vol. 1. The Negrites. The Nigritians. The Fellatahs. By Jerome Dowd. Pp. 493. 8¾ x 6 inches. New York: Macmillan Co. 1907.

The Pearl. Its story, its charm and its value. By W. R. Cattelle. Pp. 376. 8 x 5½ inches. Illustrated. Philadelphia: J. B. Lippincott & Co. 1907. $2.00 *net.*

Mathematical Geography. By Willis E. Johnson. Pp. 336. 7½ x 5¼ inches. Illustrated. New York: American Book Co. 1907. $1.00.

Larger Types of American Geography. By Charles A. McMurry, Ph. D. Pp. 271. 7½ x 5½ inches. Illustrated. New York: The Macmillan Co. 1907. $0.75 *net.*

The types selected by Mr McMurry are: The Appalachian Mountains; the Rocky Mountains; the Pennsylvania Railroad; the first Pacific Railroad; the Mississippi River; the iron and steel business; cotton mills and cotton manufacture; New York City.

Natural Introductory Geography. By Jacques Redway and Russell Hinman. Pp. 146. 10¼ x 8¼ inches. Illustrated. New York: The American Book Co.

Natural School Geography. By Jacques Redway and Russell Hinman. Pp. 172. 12½ x 10 inches. Illustrated. New York: The American Book Co.

Library of Travel. An attractive, classical library of travel in six volumes. New York: Houghton, Mifflin & Co.

The titles are: "Our Old Home," Nathaniel Hawthorne; "The American in Holland," William Elliott Griffis; "A Little Tour in France," Henry James, Jr.; "Castilian Days," John Hay; "Italian Journeys," William Dean Howells; "In the Levant," Charles Dudley Warner. Each volume is printed in large type and contains a number of illustrations. These works will probably continue for many years the standard description of these countries.

Scenes from Every Land. A collection of 250 illustrations from the NATIONAL GEOGRAPHIC MAGAZINE. Edited by Gilbert H. Grosvenor. Pp. 225. 7 x 10 inches. With map and bibliography. Washington: National Geographic Society. 1907. $1.00.

The Springfield *Republican* says: "A highly instructive book of pictures published by the National Geographic Society at Washington is 'Scenes from Every Land,' a collection of 250 illustrations from the NATIONAL GEOGRAPHIC MAGAZINE, picturing the people, natural phenomena and animal life in all parts of the world. The editor does not claim for his little book any great mission, but he reminds us in his preface that "Geography also has its lighter side. The returned traveler always finds at

Dancing Girls in Borneo

From "Every Day Life Among the Head-hunters," by Dorothy Cator

home an audience appreciative of his tale of strange sights in foreign lands." And these pictures, taken from good photographs and published in a substantial, inexpensive form, should serve the purpose of interesting a great many people in one phase or another that had escaped notice. It is not too fine or costly to put into the hands of children, and should be of real value in arousing a liking for geography. It might well for this reason find a place in school libraries. All these pictures have been published to illustrate articles in the NATIONAL GEOGRAPHIC MAGAZINE, and the bound volumes can be found in any good public library for reference by those whose curiosity is aroused, and the books whose titles are quoted will be found helpful in study."

Home Life in All Lands. By Charles Morris. Pp. 316. 7½ x ¼ inches. Illustrated. Philadelphia: J. B. Lippincott Co. 1907.

The Land in the Mountains. Being an account of the past and present of Tyrol. By W. A. Baillie-Grohman. With an introduction by Charles Landis. Pp. 288. 9 x 6 inches. Illustrated. Philadelphia: J. B. Lippincott Co. 1907. $5.00.

Under the Syrian Sun. The Lebanon, Baalbek, Galilee, and Judæa. By A. C. Inchbold. Pp. 262. 9¼ x 6½ inches. Illustrated. 2 vols. Philadelphia: J. B. Lippincott & Co. 1907. $6.00 *net.*

Syria, the Desert and the Sown. By Gertrude Lowthian Bell. Pp. 347. 8¾ x 5½ inches. Illustrated. E. P. Dutton & Co. 1907. $3.00 *net.*

Nigeria, Our Latest Protectorate. By Charles H. Robinson. 9 x 6 inches. Illustrated. London: Horace Marshall & Son.

The Pulse of Asia. A journey in Central Asia illustrating the geographic basis of history. By Ellsworth Huntington. Pp. 415. 8¾ x 6 inches. Illustrated. New York: Houghton, Mifflin & Co. 1907. $3.50.

Physiography. By Rollin D. Salisbury, Head of the Department of Geography, University of Chicago. Henry Holt & Co. 1907. 8vo. $3.50.

This volume, uniform in size and binding with the Textbook of Geology by Chamberlin

A Duck Farm in the United States

From "How the World is Fed," by Frank G. Carpenter. Copyright by Mr Carpenter

and Salisbury, is by far the most comprehensive book on this subject which has been published in this country. Its 770 pages evince the importance which physiography has assumed among the geologic sciences. The scope of the book may be gained from the chapter titles, which are as follows: Relief Features, The Work of the Atmosphere, The Work of Ground Water, The Work of Running Water, The Work of Snow and Ice, Lakes and Shores, Vulcanism, Crustal Movements, Origin and History of Physiographic Features, Terrestrial Magnetism, Earth Relations, General Conception of the Atmosphere, Constitution of the Atmosphere, Temperature of the Air, The Moisture of the Air, Atmospheric Pressure, General Circulation of the Atmosphere, Weather Maps, Climate, General Conceptions of the Ocean, Composition of Sea Water, The Temperature of the Sea, The Movements of Sea-water, The Life of the Sea, Materials of the Sea Bottom, Relations of the Sea to the Rest of the Earth.

The book is intended primarily for the use of college students, with whose needs its author is eminently familiar. The text statements are unusually clear and precise and the 707 diagrams and half-tone illustrations are especially well selected. Besides these, there are 26 plates reproducing portions of topographic sheets of the U. S. Geological Survey.

Features deserving especial commendation are the unusual amount of attention devoted to the larger relief features of the earth's surface, the clearness with which the motions and astronomic relations of the earth are set forth, and the directions for topographic map studies at the close of many of the chapters.

EDSON S. BASTIN,
U. S. Geological Survey.

A Trip to the Orient. By Robert Ulric Johnson. Pp. 392. 5¾ by 8 inches. Illustrated. Philadelphia: John C. Winston Co. 1907.

Mr Jacob gives a very entertaining story of a Mediterranean cruise, his chapters about Constantinople being particularly good. A valuable feature of the book is the large number of illustrations from photographs, there being nearly 200 views in Funchal, Granada, Algiers, Malta, Athens, Constantinople, Cairo, Jerusalem, Luxor, Naples, and Nice.

LOWEST POINT IN THE UNITED STATES

THE United States Geological Survey has just completed a line of spirit levels through Death Valley, California, and, much to the surprise of every one familiar with the region, has ascertained that the depth of that area is not so great as was supposed. The final computations of the results have not yet been made, but the preliminary figures give

for the lowest point a depth of 276 feet below sea-level. Bennetts Well, which is near this point, is 266 feet below sea-level. These figures may be altered by two or three feet when the final computations are made, but they are probably not more than three feet in error. The Geological Survey now has elevation marks on the highest and lowest points on dry land in the United States.

It is a strange coincidence that these two extremes are both in southern California and only 75 miles apart. Mount Whitney is a foot or two over 14,500 feet above sea-level, while Death Valley, as above stated, is 276 feet below. Before the Salton Sink, also in southern California, was flooded by the Colorado River, it contained the lowest point of dry land in the United States, a spot 287 feet below sea-level.

Previous estimates of the depth of Death Valley based on barometer readings gave for the lowest point figures varying from 250 to 450 feet below sea-level. The level line of the Geological Survey is believed to be the first accurate determination of elevations in that locality that has ever been made.

IMAGINATION AND GEOGRAPHY

THE following editorial from the Boston *Herald* of November 23 is reprinted here, as it is believed those members of the National Geographic Society who have not seen the article will be interested to read this appreciation of the work of the organization:

The National Geographic Society of Washington, D. C., is doing a work, through the monthly publication of its magazine, which no intelligent man or woman can afford to remain ignorant of. Geography by itself is ordinarily thought a dry subject. Geography, on the contrary, based on geology or the vivid presentation of the great physical features of the earth on which depend all civilizations, customs, avocations, sciences, and literatures, easily becomes one of the most fascinating of studies, or even of mere cursory skits of reading.

Strange to add, in its bearing on such affections of the heart as ardent love of country and patriotic pride in its great foreordained destinies, here is an agency the force of which cannot be overstated. Indeed, the modern innovation of hatching chickens by incubators instead of hens is simply nowhere compared with the system of hatching patriots of the stamp of William Tell by geological geography, as exemplified in the faith and works of the National Geographic Society of Washington, D. C.

This is no wild paradox. In truth, have not the gravest historians insisted that the reason why there is no such thing as the existence of patriotic sentiment in China is solely due to the fact that the human heart is incapable of loving 400,000,000 fellow-creatures one knows nothing about. They are a pure numerical abstraction to a man. Of their lives, languages, aspirations, joys, and sorrows he is ignorant of every concrete item, unless that they all wear the national pigtail; and so, even this dangling appendage is not potent enough to bind the people together in the chords of universal love.

Just the same used to be asserted of the United States of America. The States were too big, too broadly dispersed, too divergent in interests, for any one to be capable of loving their multitudinous populations as fellow-countrymen. All this, however, at any rate in the eyes of the National Geographic Society of Washington, is now rapidly being done away with. It is getting effected through a vivid appeal to the visual imagination which is enabling us all to see, in the mind's eye, our whole country at once and as a whole. The stupendous national enterprises already completed, or about to be inaugurated, are fast annihilating all lines of geographical division, and enlisting the minds and hearts of the scattered millions in vast undertakings in which all share a common interest and common pride.

Let any one, for example, read the National Geographic Society's article on "The Deep-water Route from Chicago to the Gulf." Here is a project simply continental in scale, especially when taken in connection with the immense water routes already existing by way of the Great Lakes, from the head of Superior to Chicago itself. What does the vast scheme imply? A 14-foot channel all the way to the Gulf of Mexico. And what is meant by the Mississippi River? Not a single stream, but the stream and all its thousands of miles of immense tributaries, the Missouri, Ohio, Tennessee, Illinois, Arkansas, Red, and countless other rivers.

The mind is fairly staggered in the attempt to take in the millions of square miles of the richest lands in the world this would open up. And, best of all, the interests of the North, South, East, and West would be indivisibly subserved by it. No more talk of congestions of freight, when every powerful towboat could tow from thirty to forty railway train loads. The local is merged in the universal. It is no more New Orleans' special route than Duluth's special route. And it is in this way—by a vivid appeal to visual imagination—that the National Geographic Society essays to enable us to focus the whole country on each one's individual eyeball, and so to abolish China.

PROPOSED CHANGE IN THE BY-LAWS OF THE NATIONAL GEOGRAPHIC SOCIETY

THE Board of Managers of the Society recommend the adoption of the following By-laws at the annual meeting of the Society on January 10, 1908. For the information of the members the present By-laws are printed after the proposed new By-laws.

ARTICLE I.—*Name.*

The name of the Society is "THE NATIONAL GEOGRAPHIC SOCIETY."

ARTICLE II.—*Object.*

The object of the Society is the increase and diffusion of geographic knowledge.

ARTICLE III.—*Membership.*

SECTION 1. The Society shall consist of members, honorary members, fellows, and patrons.

SEC. 2. Members shall be persons interested in the increase and diffusion of geographic knowledge.

SEC. 3. Honorary members shall be persons who have attained eminence by the promotion of geographic science. They shall not be members of the corporation, nor shall they vote or hold office.

SEC. 4. Fellows shall be persons engaged in scientific work pertaining to geography. They shall be members of the corporation.

SEC. 5. Patrons shall be persons interested in geography who have contributed one thousand dollars ($1,000) or more to the objects of the Society; they shall be entitled to all the privileges of membership for life.

SEC. 6. The election of members, honorary members, fellows, and patrons shall be entrusted to the Board of Managers.

ARTICLE IV.—*Officers.*

SECTION 1. The administration of the affairs of the Society shall be intrusted to a Board of Managers composed of not more than 24 members, eight of whom shall be elected by the Society at each annual meeting to serve for three years or until their successors are elected. A majority of the votes cast shall be necessary for election.

SEC. 2. The officers of the Society shall be a President, a Vice-President, a Secretary, and a Treasurer, who shall be elected annually by the Board of Managers from its own number. The Board shall also elect an Editor, who shall have general charge of the work of the office, subject to the direction of the Executive Committee; an Assistant Treasurer, and an Assistant Secretary.

SEC. 3. The President shall preside at the meetings of the Society and of the Board of Managers, or in the absence of the Vice-President, may delegate this duty to some other member of the Board.

SEC. 4. In the absence of the President, his duties shall devolve upon the Vice-President.

SEC. 5. The President and Secretary shall sign all written contracts and obligations of the Society.

SEC. 6. The Treasurer shall have charge of the funds of the Society under the direction of the Board of Managers, and shall make collections and disbursements and render a semi-annual report and such special reports as may be called for by the Board; and his accounts shall be audited by a Committee semi-annually, and at such other times as the Board may direct.

SEC. 7. The Secretary shall record the proceedings of the Society and of the Board of Managers, conduct correspondence, and submit an annual report to the Board, and to the Society at its annual meeting.

SEC. 8. The Board of Managers shall fill vacancies arising in the Board and among the officers.

SEC. 9. The Editor shall, under the direction of the Executive Committee, have charge of the general business of the Society in accordance with the By-Laws and with such instructions as may, from time to time, be given by the Board of Managers. All employees of the Society shall perform their duties under his personal supervision.

SEC. 10. The Assistant Treasurer shall, under the direction of the Treasurer, perform such duties in connection with the disbursement of the funds of the Society and the preparation of vouchers, abstracts and reports as the Treasurer may direct.

SEC. 11. The Assistant Secretary shall perform such duties as the Secretary may delegate to him and shall also assist the Editor in the general management of the affairs of the office. In the absence of the Editor, he shall have general charge of the office work.

ARTICLE V.—*Committees.*

SECTION 1. There shall be an Executive Committee consisting of the President, Vice-President, Secretary and Treasurer, and three others to be elected annually by the Board of Managers from its own members.

SEC. 2. As soon as practicable after the annual meeting, the President shall appoint the following Standing Committees, the members of which shall serve until their successors are designated.

1. Committee on Rules.
2. Auditing Committee.
3. Committee on Finance.
4. Committee on Membership.
5. Committee on Research.
6. Committee on Publications and Lectures.

The President shall be *ex officio* a member of each Standing Committee, and shall be Chairman of the Executive Committee.

ARTICLE VI.—*Duties of Committees.*

1. Executive Committee.

The Executive Committee shall, during the intervals between the meetings of the Board of Managers, possess and exercise all of its powers and functions, except as to matters consideration of which may be prohibited by said Board; provided that full reports of all such proceedings shall be made to the next succeeding regular meeting of the Board.

2. Committee on Rules.

The Committee on Rules shall consist of the President of the Board of Managers and three other members, to whom shall be referred all motions to alter or modify the By-Laws, and who shall report thereon at the next meeting of the Board.

3. Auditing Committee.

The Auditing Committee shall consist of three members of the Society, not more than one of whom shall be a member of the Board of Managers. It shall examine the semi-annual reports of the Treasurer with the vouchers for expenditures, and report thereon at the next regular meeting of the Board of Managers.

4. Finance Committee.

The Finance Committee shall consist of three members of the Board of Managers. It shall act as an advisory committee to the Board of Managers in all financial matters.

5. Committee on Membership.

The Committee on Membership shall consist of three members, whose duty shall be to inquire as to the eligibility of all applicants for membership whose names may be referred to it, and to report thereon to the Board of Managers for its final action.

6. Committee on Research.

The Committee on Research shall be charged with the consideration of all matters of scientific and technical geography, including exploration, which may be brought before the Society, or which may originate in the Committee; and shall report thereon to the Board of Managers, with recommendations for action. Subject to the approval of the Board of Managers, it may form a technical section within the Society, which is authorized to use for its meetings and discussions the hall of the Hubbard Memorial Building.

7. Committee on Publications and Lectures.

The Committee on Publications and Lectures shall consist of the President, the Editor, and the Secretary, to which Committee shall be referred for approval all proposed publications of the Society other than the Magazine. This committee will also make arrangements for all lectures under the auspices of the Society.

ARTICLE VII.—*Finances.*

SECTION 1. The fiscal year of the Society shall begin on the first day of January.

SEC. 2. The annual dues of members shall be $2.00, payable in January.

SEC. 3. Fellows shall pay an initiation fee of $10.00 on notice of election.

SEC. 4. Members or fellows, on approval of the Board of Managers, may commute annual dues and acquire life membership by the payment at one time of $50.00. Life members shall be entitled to two admissions to each lecture and course.

SEC. 5. Members or fellows whose dues remain unpaid on March 1 shall be notified by the Treasurer that unless dues are paid within one month they will be in arrears and not entitled to receive the publications of the Society or to purchase tickets on members' terms. Members or fellows one year in arrears may, after formal notification, be dropped from the rolls of the Society. Objectionable members may be dropped by a two-thirds vote of the Board of Managers at any regular meeting.

ARTICLE VIII.—*Expenditures.*

There shall be prepared annually by the Editor under the direction of the Finance Committee, about October 1st, a statement showing the probable income and the probable expenditures for the ensuing year. The Board of Managers will then determine the amount of available funds to be applied to each of the activities of the Society, naming in each case the maximum amount that may be expended. It shall be the duty of the Treasurer to report to the Board whenever there appears to be a probability that the income will not be sufficient to meet the several allotments.

ARTICLE IX.—*Publications.*

The Society shall publish a journal or periodical under the title, "THE NATIONAL GEOGRAPHIC MAGAZINE," which shall be sent to all classes of members of the Society, not in arrears, and may be placed on sale. The Society may also publish such special books, monographs and reports as the Board of Man-

agers may authorize. The special publications shall not be a prerogative of membership.

ARTICLE X.—*Medals.*

The Society, by vote of the Board of Managers, may award medals for distinguished accomplishment in geography.

ARTICLE XI.—*Meetings.*

SECTION 1. The annual meeting of the Society shall be held in the District of Columbia on the second Friday in January. Twenty members or fellows shall constitute a quorum.

SEC. 2. Special meetings may be ordered by the Board of Managers or called by the President.

SEC. 3. Regular meetings of the Board of Managers shall be held on the third Wednesday in October, December, January, April, and June; special meetings may be held at the call of the President or on notice signed by five members of the Board. Seven members shall constitute a legal quorum of the Board.

SEC. 4. Lectures and lecture courses may be provided by the Board of Managers. Free admission to such lectures shall not be a prerogative of membership, except as otherwise provided in these By-Laws, but tickets shall be sold to members and fellows on more favorable terms than to non-members.

SEC. 5. Cushing's Manual shall be the parliamentary guide and govern the proceedings of the National Geographic Society and the Board of Managers when not in conflict with the specific provisions of these By-Laws.

ARTICLE XII.—*Amendments.*

These By-Laws may be amended by a two-thirds vote of the members of the Society present at any meeting, provided the proposed amendments are reported by the Board of Managers, and provided that notice thereof has been sent to all members of the Society not less than 10 days before the meeting. The publication of the proposed amendments in THE NATIONAL GEOGRAPHIC MAGAZINE shall be sufficient notice within the meaning of this article.

PRESENT BY-LAWS OF THE NATIONAL GEOGRAPHIC SOCIETY

ARTICLE I.—*Name.*

The name of this Society is *The National Geographic Society.*

ARTICLE II.—*Object.*

The object of the Society is the increase and diffusion of geographic knowledge.

ARTICLE III.—*Membership.*

SECTION 1. The Society shall consist of members, honorary members, fellows,* and patrons.

* No fellows have as yet been elected.

SEC. 2. Members shall be persons interested in geographic science.

SEC. 3. Honorary members shall be persons who have attained eminence by the promotion of geographic science. They shall not be members of the corporation, nor shall they vote or hold office.

SEC. 4. Fellows shall be persons engaged in scientific work pertaining to geography. They shall be members of the corporation.

SEC. 5. Patrons shall be persons interested in geography who have contributed one thousand dollars or more to the objects of the Society; they shall be entitled to all the privileges of membership for life.

SEC. 6. The election of members, honorary members, fellows, and patrons shall be entrusted to the Board of Managers.

ARTICLE IV.—*Officers.*

SECTION 1. The administration of the Society shall be entrusted to a Board of Managers composed of twenty-four members, eight of whom shall be elected by the Society at each annual meeting to serve for three years, or until their successors are elected. A majority of the votes cast shall be necessary for election.

SEC. 2. The Board of Managers shall elect annually from their own number a President and a Vice-President, and shall elect annually a Treasurer and a Secretary.

SEC. 3. The President shall preside at the meetings of the Society and of the Board of Managers, or may delegate this duty. The President and the Secretary shall sign all written contracts and obligations of the Society.

SEC. 4. In the absence of the President his duties shall devolve on the Vice-President.

SEC. 5. The Treasurer shall have charge of the funds of the Society, under the direction of the Board of Managers, and shall make collections and disbursements and render an annual report, and his accounts shall be audited by a committee of the Society, not members of the Board, annually and at such other times as the Board may direct.

SEC. 6. The Secretary shall record the proceedings of the Society and of the Board of Managers, conduct correspondence, and make an annual report.

SEC. 7. The Board of Managers shall fill vacancies arising in the Board.

SEC. 8. All officers shall serve until their successors are chosen.

ARTICLE V.—*Committees.*

SECTION 1. The Board of Managers shall select annually from its own number an Executive Committee.

SEC. 2. There shall be standing committees on Publications, Communications, Admissions, Research, and Finance, whose chairmen shall be members of the Board of Managers. These

committees shall be appointed immediately after the annual election of the President, to serve until their successors are designated.

SEC. 3. The committees of the Society and of the Board of Managers shall be appointed by the President except when otherwise provided. The President shall be a member *ex officio* of every committee.

ARTICLE VI.—*Finances.*

SECTION 1. The fiscal year of the Society shall begin on the first day of January.

SEC. 2. The annual dues of members shall be two dollars, payable in January.

SEC. 3. Fellows shall pay an initiation fee of ten dollars on notice of election.

SEC. 4. Members or fellows may commute annual dues and acquire life membership by the payment at one time of fifty dollars.

SEC. 5. Members or fellows whose dues remain unpaid on March 1 shall be notified by the Treasurer that unless the dues are paid within one month they will be in arrears and not entitled to vote at the annual meeting, to receive the publications of the Society, or to purchase lecture tickets on members' terms. Members or fellows one year in arrears shall, after formal notification, be regarded as having withdrawn from the Society.

SEC. 6. The funds of the Society may be invested and loans may be negotiated in the interests of the Society, and any other financial business germane to the purposes of the Society may be transacted, by the Board of Managers.

ARTICLE VII.—*Meetings.*

SECTION 1. Regular meetings of the Society shall be held on alternate Fridays from November until May.

SEC. 2. Special meetings may be ordered by the Board of Managers or called by the President.

SEC. 3. The annual meeting shall be held in the District of Columbia on the second Friday in January.

SEC. 4. Twenty members or fellows shall constitute a quorum.

SEC. 5. Regular meetings of the Board of Managers shall be held on the same days as the regular meetings of the Society; special meetings may be held at the call of the President or on notice signed by five members of the Board: *Provided,* That for any of its own meetings the Board may substitute meetings of the Executive Committee.

SEC. 6. Lectures and lecture courses may be provided by the Board of Managers. Free admission to such lectures shall not be a prerogative of membership, but tickets shall be sold to members and fellows on more favorable terms than to non-members: *Provided,* That each life member who acquired life membership prior to the year 1901 shall be entitled to two admissions to each lecture and course.

ARTICLE VIII.—*Publications.*

The Society shall publish a journal or periodical under the title, *The National Geographic Magazine,* which shall be sent to all members and fellows of the Society not in arrears, and may be placed on sale.

ARTICLE IX.—*Amendments.*

These By-Laws may be amended by a two-third vote of the members present at any regular meeting, provided the proposed amendments are reported by the Board of Managers, and provided that notice thereof has been sent to all members of the Society not less than ten nor more than sixty days before the meeting. The publication of proposed amendments in The National Geographic Magazine shall be deemed a notice within the meaning of this article.

THE NATIONAL GEOGRAPHIC SOCIETY

Friday, December 13, 1907—"The Land of the Incas." Mrs Harriet Chalmers Adams, author of "The City that was Exchanged for New York," "East Indians in the New World," in the NATIONAL GEOGRAPHIC MAGAZINE for June and July, 1907. Illustrated.

December 14, 1907—Annual Banquet. The New Willard.

Friday, December 20, 1907—"The Second Peace Conference at The Hague." Hon. John W. Foster, formerly Secretary of State.

Friday, January 3, 1908—"The Geography of Mars." Percival Lowell, LL.D., Director of the Lowell Observatory, of Flagstaff, Arizona.

Friday, January 10, 1908—Annual Meeting, Reports and Elections. "Two Thousand Miles on Muleback through the Andean Wonderland." Hon. John Barrett, Director of the International Bureau of American Republics. Illustrated.

Friday, January 17, 1908—"A Camel Trip in the Salt and Sand of Chinese Turkestan." Mr Ellsworth Huntington, of Yale University, author of "The Pulse of Asia." Illustrated.

Friday, January 24, 1908—"The Pelicans of America: An Account of Field Studies of the White Pelican in the Western States and in Northwest Canada, and of the Brown Pelican in Florida." Mr Frank M. Chapman, of the American Museum of Natural History. Illustrated.

Friday, January 31, 1908—"The Conservation of Our Natural Resources." Mr Gifford Pinchot, Chief of the U. S. Forest Service.

Friday, February 7, 1908—"South Africa: The Natives and the Mines." Mr Gardiner F. Williams, author of "The Diamond Mines of South Africa" and for many years General Manager of the De Beers Diamond Mines, Kimberley. Illustrated.

Friday, February 14, 1908—"The Deep-water Route from Chicago to the Gulf and its Connections." Hon. Joseph E. Ransdell, Member of Congress from Louisiana and President of the Rivers and Harbors Congress.

Friday, February 21, 1908—Hon. George Shiras, 3rd, of Pittsburg, has accepted the invitation of the National Geographic Society to address the Society on some of his experiences in hunting wild game with the camera. Illustrated.

Friday, February 28, 1908—"Holland's War with the Sea." Prof. J. Howard Gore. Illustrated.

Friday, March 6, 1908—"The Missions of California." Hon. Joseph R. Knowland, Member of Congress from California.

Friday, March 13, 1908—"Arizona—The Egypt of the New World." Mr Frederick Monsen. Mr Monsen describes not only the ancient ruins, but the country as it is today, with its Indian tribes, Spanish-Mexican settlements, and American towns. The wonderful Snake Dance of the Hopis will be shown.

Friday, March 20, 1908—"Persia—Past and Present." Dr A. V. Williams-Jackson, of Columbia University. Illustrated with unusual pictures taken by Professor Jackson on extensive journeys through the ancient kingdom.

Friday, March 27, 1908—"The Geography of the Sea." Rear Admiral Colby M. Chester, U. S. Navy.

Friday, April 3, 1908—"Cathedrals, Mosques, and Temples of the World." Hon. O. P. Austin, Chief U. S. Bureau of Statistics. Illustrated.

LAKE CAHUILLA

The Ancient Lake of the Colorado Desert

AT a recent meeting of the Cosmos Club of Tucson, the following communication was read by Mr William P. Blake, emeritus professor of geology, University of Arizona.

The ancient sheet of water which in comparatively recent geologic time filled the basin of the Colorado Desert, below the sea-level, and left the records of its occupation of the valley by deposits of travertin upon its rocky shores, by lines of deserted beaches, by deposits of lacustrine clays holding myriads of fossil fresh-water shells, and all below the level of the Gulf of California, were for the first time recognized and described by me, in the year 1853, in a San Francisco newspaper edited by J. D. Whelpley, and afterwards in the Report of Geological Reconnaissance in California, 1854-5, and in volume v of United States Explorations and Surveys from the Mississippi River to the Pacific Ocean.

The outline of the lake—its length, breadth, and depth—its relations to the Colorado River and the Gulf, its origin and history, were described at that time, and these descriptions and this theory of origin have since been confirmed and sustained by later explorations.

Public attention has of late been directed toward the region by reason of its partial submergence and the destruction of the salt beds at Salton, in the lowest part of the valley. This new sheet of water, which does not rise to the ancient lake-level, is known as the "Salton Sea" and is appropriately named; but this name should not apply to the ancient lake in its entirety, which requires a distinctive designation, just as, for example, the ancient sheet of water of which the great Salt Lake is a residue is known as Lake Bonneville.

As the original discoverer and describer of the ancient lake, I suggest the propriety of giving it a name, and propose "Lake Cahuilla," Cahuilla being the tribal name of the aborigines who were found living in and about the valley now very generally known as the Cahuilla Valley and whose descendants are still there.

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